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No. 8

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ELECTRIC POWER

ENERGY PRODUCTION GOALS ASSESSED

Novosibirsk EKO [EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA]
No 11, 1979 pp 50-59

[Article by L. Ya. Donchak, Candidate of economics, chief economist of the Leningrad "Energomashproyekt" Association: "How Can We Hit the Mark"]

[Text] Heat power engineering, which provides approximately 87 percent of the total electric energy produced in the USSR, has experienced a kind of technical revolution in connection with the transition to power plants with higher technological parameters. It has been possible significantly to improve the decisive indicator of energy-producing equipment--efficiency. On account of the qualitative improvement of energy-producing facilities over a period of 15 years, beginning in 1960, there has been attained a relative savings of approximately 85 million tons of standard fuel, a savings estimated on the basis of terminal expenditures at over R 1.5 billion. For comparison, the savings exceeded the value of the fixed capital of all the enterprises of the USSR Ministry of Power Machine Building in 1960. If there had actually arisen the problem of insuring a supplementary supply of such a quantity of fuel, capital investments of R 2.5 to 3 billion would have been required as well as the diversion of 40,000 to 50,000 workers.

These figures indicate that the qualitative improvement of energy-producing facilities was and remains one of the most important factors insuring high rates of electric power production. The importance of this factor was further amplified during the 10th Five-Year Plan and as the economy develops it will continue to grow; for this reason, it is necessary continuously to improve the principles and methods of controlling the process of enhancing quality.

The development of the production organizations is for the most part nonintegrated; it is based on uncoordinated technical-economic measures. As a result, the basic production processes are distinguished by advanced machinery and technologies, but the transitions and the ancillary processes are still based on manual labor. The development of the economic organizations is irregular and, above all, disconnected. We need specific scientific-technical programs, on the basis of which it will be possible to attain complex technical production development and real improvement of output quality and production efficiency. A specific program will allow strict coordination--in terms of technology as well as time--of all stages, from the scientific idea to the series production of new goods.

A program of this kind must contain three basic orientations:
--improvement of the structure of the production complex.
--improvement of the production process.
--modernization and qualitative improvement of production.

Production--the Main Reference Point of the Program

The traditional classification of the orientations of scientific-technological progress (mechanization, automation, electrification, chemization) does not sufficiently reflect the structure of the production processes or the interrelationship of the functional elements. For example, automation may simultaneously concern the tools of labor and the production technology. Electrification describes both the technical equipment for a single worker and for the entire technological process. The orientations of technological development should be classified in accordance with the functional production elements. The cardinal objective of this classification is to meet the demand of society for high-grade goods produced by the economically most efficient method.

During the present five-year plan, for example, the "Leningrad Metal Plant" Association produced a steam turbine with a capacity of 1,200,000 kilowatts, and for the Sayano-Shushenskiy Hydroelectric Power Station, it produced hydraulic turbines unmatched in the world. Thus the association enters the 11th Five-Year Plan on a high technical level of production and with stable production processes. However, just on the basis of the above data, can one say that the association played its part in the national economy? No. Output of goods on the productions list assigned, within the time limits set, maintenance of a high level of quality for all turbines stipulated in the five-year plan, optimal utilization of production resources--this is a set of indicators on the basis of which one can say: The "Leningrad Metal Plant" performs its function in the national economy.

The largest association does not fully control--in accordance with the basic indicators--the processes determining the demand for its output; nor does it control the resources or the growth rates. The practice of the Leningrad associations shows that under the present conditions the technical level and the quality of production are contingent above all on antecedent measures concerning the modernization of production. For this reason, the primary task in the development of a complex program of technical development is to disclose what is required of production and to meet those requirements. At this stage are determined the characteristics of new output--such as the weight and size of the product as a whole and of its most important units--and the test and transport conditions. Not infrequently, these characteristics necessitate changes in the structure of the production complex.

In the design of the product, there is embedded that potential efficiency which can be attained under operating conditions. But real efficiency will be obtained only if the article is produced at short notice and in total conformity with the technical specifications. This is contingent upon the level of production preparation, and in our opinion, the importance of this factor has not yet been duly recognized. It is precisely the timely preparation of the production complex that determines--above all in heavy machine building, power machine building, and electrical engineering--the qualitative improvement of production and the times for production modernization.

If a production complex and its structure are relatively stable and the value of the fixed assets is quite high, changes are very costly. The modernization of an old production complex and the construction of a new one are carried out with due regard for the long-term perspective. For this reason, the scientific-technological program of the enterprise must be a specific program for providing the national economy with new products of superior quality. It is impossible to develop and implement such a program without support by industrial, planning and research organizations.

Such a program must contain a prognosis of the demand for appropriate types of equipment, a prognosis of scientific-technical advances in regard to tools of labor, a technical-economic substantiation of potential variants of the development of the production complex, technical and economic studies of manufacturing methods, and estimates of capital investments and of the economic efficiency and expediency of the measures drafted.

Quite frequently, one encounters two rather typical prognostic errors: Overestimation of the short-term prospects and underestimation of the long-range perspectives of the development of production. These errors are manifested in the fact that the final economic result based on the technology developed or to be developed at the given moment is overstated, while the economic possibilities of a qualitatively new technology, which requires prolonged and intense effort in regard to preparing it for introduction in industry, are for the most part minimized. As a result, there is a reduction in the resources directed toward the development of appropriate production programs, and technologically the sector lags behind the development in other countries. Something similar happened in the power machine building industry in the 1950's and 1960's, when the development of nuclear energy was considered a remote possibility. In spite of the fact that scientists had pointed out the importance of extending the work on nuclear energy, the planning organs did not heed their recommendations; consequently, the rate of development of an important orientation of power machine building and of the country's power engineering as a whole slowed down.

Formulation of a complex specific program is especially important for the development of large-scale production associations, since it will help to concentrate the resources on crucial projects and thus to obtain a greater effect due to the qualitative improvement of production.

The "Leningrad Metal Plant" Association, for example, built and put in operation--at a cost of R 3.5 million--a testing stand for balancing turbine rotors at rated speeds. The wholesale factory price of the turbines did not go up, even though the production costs increased, and since the customers' assembly costs were reduced, there resulted a savings of R 2 million per year.

Another example from the practice of this association illustrates what the preparation of production for new output means for the national economy. At the main plant, there has been built--on the threshold of series production of steam turbines with a capacity of 800,000 and 1,200,000 kilowatts--a unique assembly-testing setup occupying over 10,000 square meters. According to calculations carried out at the association and coordinated with the buyer, operation of these two turbine types will yield the national economy annual savings of R 5.7 million and 9.2 million, respectively, as compared with the 300-kilowatt turbine produced previously.

Specialization and Concentration

We have become accustomed to regarding this phenomenon in the economic system as the basis for sharp increases in production volume. We sometimes forget that product specialization and concentration is one of the prerequisites for high and stable product quality. It insures economically justified, extensive utilization of specialized precision equipment, including machine tools equipped with ChPU [Numerical Preset Control]. This promotes the use of ASUTP [Automated System for Control of Technological Processes]. The limitation of manufacturing operations raises the level of production organization and improves working conditions.

During the preceding five-year plan period, the "Leningrad Metal Plant" Association produced over 50 percent of the all-union capacity of new power steam turbines and over 60 percent of the capacity of hydraulic turbines, thus creating the preconditions for an intensified orientation of the individual production programs toward the production of specialized goods. In accordance with the complex specific program for the development of the association, there are being established:

--a branch of the main plant with a specialized assembly-welding shop for gas turbines, boosting the individual unit's capacity from 100,00 to 200,000 kilowatts and delivering them in large manufacturing sets.

--specialized production complexes for steam and hydraulic turbines at the main plant.

--a turbine-vane plant with a specialized set-up base, producing turbine vanes for the association and for the sector as a whole.

Along with the specialization of the association's production complexes, there is the specialization of shops and sections. Labor productivity is increasing and turbine quality is being improved. So far, the improvement of turbine quality has inevitably brought about a reduction in both machine and labor productivity, since there has been an improvement in those production aspects, which for the most part were not reflected in the physical and cost indicators of the association's operation, which--to put it more precisely--lowered them. Thus, organization of the production of cast or forged billets with smaller machining allowances has reduced their output in terms of tonnage, number and price. Evidently, the same thing is happening in the production organization regarding precision castings, stamping dies and shaped stock, which was planned in the association.

Moreover, it is not always possible to "accommodate" the program for modernization and qualitative improvement of production in the five-year plan. In the "Leningrad Metal Plant" Association, many projects are carried over from one five-year plan to the next. This is what happened in the case of the K-500 and K-1200 steam turbines and what will probably happen with the new turbines. In order to curtail the turbine modernization cycle, much work is being done in regard to standardization and component specialization. For example, the K-800 turbine is to become the basic high-capacity turbine, and it is planned to limit the condensor-type turbines to six modifications over a power range extending from 125,000 to 1,200,000 kilowatts. The same limitations are planned for hydraulic turbines. On the basis of the experience gained by related enterprises and associations, one can expect that by standardizing the turbines and curtailing the products lists, it will be possible to reduce the planning times and the production preparation for new models by approximately 20 to 30 percent.

During the Ninth Five-Year Plan, even a partial implementation of the plans concerning production specialization and concentration made possible marked increases in production volume and product quality. For the association, the overall annual effect resulting from the development of new and modernized products amounted to R 70 million. As regards the 10th Five-Year Plan, the results were even more appreciable. For the association's customers, the savings on current expenditures alone amounted to no less than R 35 million. On the basis of established correlations, the output of new turbines makes possible capital investment savings in the fuel-producing sectors amounting to no less than R 90 million. By and large, in estimating the amount of capital investments necessary for implementation of the complex plan concerning output--at a set rate--of products of superior quality, one can safely say that it falls far short of the amount of investments that would have been required in the fuel-producing and other sectors, if the previous level of turbine quality had been maintained.

Economic Incentives and Financing

The large number of sources for the financing of projects is one of the key factors complicating implementation of the specific quality improvement program in the "Leningrad Metal Plant" Association: The buyer's capital, the unified fund for scientific-technological development, internal resources, etc. This situation tends to reduce the responsibility of the individuals developing new forms of production and it complicates accounting of the actual cost of industrial prototypes. No solution has been found to the problem concerning inclusion in the realized production volume of those operations that are financed directly from the unified fund. However, subcontractors for these operations are not affected by this problem. Thus it is not surprising that by and large there is a tendency to reduce the relative share of operations, which are carried out by the enterprises at the expense of the unified fund, and to increase the share of those funds that are directed to other ministries and departments. As regards the unified fund for scientific-technological development, the associations and enterprises are not concerned with economy.

The funds earmarked for the payment of bonuses for new technologies are likewise very insignificant. Their relative share of the total payments from the material incentive fund does not exceed 4 percent. Some economists have proposed completely to eliminate such bonuses and to combine the bonus fund for new technologies with the incentive fund for overall results.

In our view, such an orientation is economically unjustifiable. Any enterprise's contribution to technological progress is determined above all by the production of new efficient equipment and high-grade goods. The realization of high-grade output at the customer's is posterior to the evaluation of the operation's cost-accounting results, for which the material incentive fund is set up. Moreover, it is precisely the personal contribution, the personal initiative of the executors which in many cases determines the utilization of scientific-technical achievements in new types of products. Hence there is an obvious need for a special bonus system bringing about maximum efficiency in the implementation of the complex plan for the modernization and qualitative improvement of production.

The wholesale price markups for improved product quality are another problem. There are too many restrictions on the right to use them; the calculation scale is incomplete, and the process of markup coordination is extremely complicated. The buyers frequently refuse their "property" until the article has been tested under operating conditions and this requires an additional 2 to 3 years; in that time, the right to fix markups is generally forfeited. The association does not have the right to deduct surcharges for each article; the calculation is based on the annual output and a highly regressive scale. For the Ust'-Ilimskiy Hydroelectric Power Station, the association produced three turbines, the economic efficiency of each of which amounted to R 1,646,000. An incentive markup of R 70,000 was fixed. The incentive funds for each turbine were to have amounted to R 42,900. In fact, on applying the deduction scale, a mere R 79,400--instead of R 128,700--were obtained. In our opinion, fixed, differentiated allowances analogous to those for products bearing the quality emblem would have been an important motivating factor in this case.

Unfortunately, the production association's system of indicators (for the quantitative and qualitative evaluation of its operation) disregards almost entirely the economic effect produced by output of high-quality products. Consequently, without prejudice to the collective it is impossible to produce goods that--although labor-intensive--are distinguished by great efficiency, goods that ensure markedly greater labor savings at both the preceding and the subsequent stages of social production.

By and large, exclusive application of cost indicators in the evaluation of the level of production modernization and improvement is detrimental to operational accounting; it intensifies the contradictions between suppliers and customers. The cost indicators should be subordinated to the physical, assortment-oriented indicators and also to the efficiency and product-quality indicators. In full measure, this should also be applied to the evaluation of the development plans for the associations' production apparatus and its preparation for the production of new, highly efficient goods.

In regard to these efforts, the specific scientific-technical programs, part of which should be programs for quality improvement, create clear perspectives. However, certain factors, which were emphasized above, lead astray even large-scale enterprises; these factors do not allow purposeful, consisten and complex quality improvement. So it is not so much a matter of drafting specific programs as of creating the economic-organizational conditions for their implementation.

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SERVICE DISRUPTIONS OF 35 KV, HIGHER VOLTAGE LINES

Moscow ELEKTRICHESKIYE STANTSII in Russian No 2, Feb 80 pp 68-70

[Article by V.G. Pidoshva, A.I. Klyuyev and N.M. Ripka, engineers, Moldglavenergo]

[Text] According to data supplied by MoldNII [Moldavian Scientific Research Institute] of Soil Science and Agrochemistry, Moldavia's soil contains 0.1-15.9 percent salts in the upper horizon (primarily in the top 10 cm of soil). The amount of salts in soil is not constant, particularly in the surface layer. The greatest buildup of salts on the surface on in the top soil takes place during the arid part of the year.

Soil is subjected to wind erosion. MoldNII of Soil Science and Agrochemistry's analyses of contaminants that have settled on the insulators of power transmission lines showed that their component elements are typical of mixtures of soil and mineral compounds of a nonsoil origin.

The Moldavian SSR lies in an area of increased thunderstorm activity. The average annual number of hours with thunderstorm activity ranges from 50 to 100. In some areas of the republic, this figure can reach 130-170 in individual years. The greatest number of thunderstorm hours (51 percent) occurs in June and July.

According to the standard thickness of the glaze-ice wall, 40 percent of Moldavia's territory belongs to Region 4 and 60 percent to Region 3. The number of days of glaze ice averages from 4 to 18 per year. The glaze-ice wall's thickness can reach 30 mm.

On the basis of wind loads, Moldavia belongs to Region 3. The number of days with strong wind (more than 15 m/s) varies, with the average being 5-50 days per year. In individual years the number of days with strong wind can reach 80-100 in some regions.

The Moldavian SSR is in the zone of inadequate moisturization. Dry winds and dust storms are possible. The amount of precipitation decreases, from the northwest to the southeast, from 560 to 370 mm. Rain of the shower type predominates during the warm part of the year. During the cold period, precipitation is of the continuous type and lasts for 5-80 h.

Fog is seen quite frequently, particularly from October to March. Throughout the republic, the average annual number of days with fog varies from 30 to 60. During the course of the year, the duration of fog changes from several tens of hours in the summer months to up to 125 h during the winter. In some cases fog may remain for several days.

Dew forms in Moldavia when the average daily air temperature passes through 2-4°C on clear or slightly cloudy nights. The maximum number of days with dew occurs during the warm part of the year, from April to October, and in the central part of the republic (for example) ranges from 10 to 18 days per month [1,2].

In the Moldavian power system, until 1972 power transmission lines for all voltages were designed without allowing for contaminants. The inadequacy of the degree of insulation for the contamination conditions were revealed particularly acutely during the first year of operation of the 400-kV power transmission line from the Moldavskaya GRES to the People's Republic of Bulgaria. Because of flashover of the insulator chain during operation at 330 kV, the line went dead four times.

On the basis of a soil salinity map of the republic compiled by MoldNII of Soil Science and Agrochemistry, as well as the experience amassed in operating the power system's power transmission lines, contamination conditions began to be taken into consideration during the planning of power networks. In conjunction with the Central Asian Department of Energoset'proyekt [All-Union State Planning, Surveying and Scientific Research Institute of Power Systems and Electric Power Networks], in 1976 a preliminary map of degrees of insulation (PKI) of VL's [overhead lines] and ORU's [outdoor distribution systems] was drawn up for the power system and used as the basis for determining zones with 2d, 3d and 4th degree contamination in Moldavia [3].

The total length of the power transmission lines that carry 35-400 kV and were erected with reinforced insulation or

Table 1.

Group	Percent of disconnections by years					
	1974	1975	1976	1977	1978	Average for 5 years
First	3	22	28	29	18	20
Second	44	62	50	54	67	55
Wrong size	7	5	5	2	7	5
Break in wire	4	3	2	1	9	4
Fallen wire	--	5	2	4	10	4
Collided with by machinery	1	2	3	2	2	2
Earthquake	--	--	--	1	--	--
Landslides	1	1	--	1	--	1
Pole caught fire	1	3	--	2	6	2
Failure (pole and crossbar decay)	1	1	4	--	4	2
Breaking of insulator chain (including damage by unauthorized persons)	1	1	4	--	3	2
Insulation (chain) flashover	1	2	10	4	2	4
Birds	--	1	--	1	--	--
Wind > 27 m/s	8	2	1	11	3	5
Dancing of wires	--	--	--	1	--	--
Glaze ice	--	--	--	--	--	--
Thunderstorms (including flashover during thunderstorms)	19	36	19	24	21	24
Third	53	16	22	17	15	25
Humidity > 80 percent	26	3	5	2	3	8
Insulator contamination	--	--	--	--	--	--
Dew	--	1	--	--	1	--
Fog	1	--	1	2	1	1
Rain, drizzle	1	2	6	4	1	3
Wind > 20 m/s	1	1	2	4	--	2
Other	24	9	8	5	9	11

insulation that was strengthened in accordance with the degree of insulation map constitutes 4,803 km, or 80 percent of the system's length. In the VL sections most subject to contamination, a system for washing power-carrying insulation with a high-pressure jet has been introduced.

The lightning protection of the power transmission lines for all voltages that are on reinforced concrete and metal poles meets the requirements of the PUE [Rules for Setting Up Electrical Installations].

Table 2.

Group	Percent of disconnections by years					
	1974	1975	1976	1977	1978	Average for 5 years
First	16	28	19	16	17	19
Second	60	63	47	63	54	57
Wrong size	7	17	10	12	4	10
Break in wire	2	4	4	3	2	3
Fallen wire	9	4	5	3	7	6
Collided with by machinery	4	3	5	3	1	3
Earthquake	--	--	--	4	--	1
Landslides	1	--	--	--	--	--
Pole caught fire	1	--	--	--	--	--
Failure (pole and crossbar decay)	1	1	--	--	1	1
Breaking of insulator chain (including damage by unauthorized persons)	1	3	1	4	3	2
Insulation (chain) flashover	2	2	6	3	5	3
Birds	1	1	--	1	--	1
Wind 27 m/s	6	3	2	15	5	6
Dancing of wires	--	--	--	--	--	--
Thunderstorms (including flashover during thunderstorms)	25	25	14	15	23	20
Third	24	9	34	21	29	24
Humidity 80 percent	4	3	5	4	4	4
Insulator contamination	1	--	--	--	--	--
Dew	7	1	5	1	3	4
Fog	1	1	6	3	3	3
Rain, drizzle	2	--	4	3	2	2
Wind 20 m/s	2	--	5	--	--	1
Other	7	4	9	10	17	10

Because of the large number of reinforced concrete and metal poles used (up to 30 percent), the protection of the 110-kV lines on wooden poles without a lightning protection cable does not meet the PUE requirements.

In the analysis of the power transmission line disconnections, all the failures were divided into three groups: 1. disconnections not related to line damage; 2. line disconnections for firmly established reasons; 3. disconnections for unestablished causes. Of those with unknown causes, we distinguished those for which the cause might be flashover of contaminated insulators because of increased humidity or moisturization. The

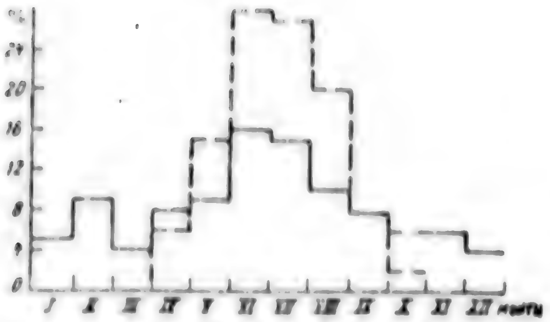

Figure 1. Intensity of thunderstorm activity and VL disconnections by months: —— = VL disconnections; --- = percentage of thunderstorms.

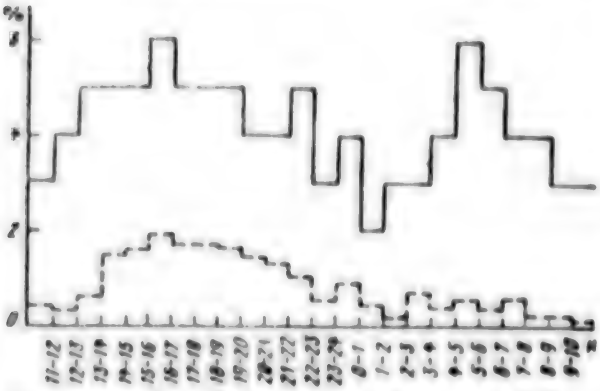

Figure 2. Distribution of VL disconnections by hourly intervals: —— = total number of disconnections; --- = disconnections during thunderstorms.

classification of 35-kV electric power transmission lines is presented in Table 1, while Table 2 gives the same information for 110-kV lines.

The classification of 220-400 kV line disconnections is not presented because of their insignificant number. Lines of this type perform quite reliably.

From the data in the tables it is obvious that a considerable number (up to 20 percent) of disconnections and failures are not related to line damage. Disconnections during thunderstorms constitute approximately the same percentage. Lines on wooden poles are disconnected most often. For instance, the average specific number of disconnections of 110-kV lines on wooden poles is approximately quadruple that of lines on reinforced concrete poles, while for 35-kV lines it is double.

In order to determine the probability that disconnections during thunderstorms occurred because of excess voltage and not for other reasons, graphs of the patterns of thunderstorm activity intensity and disconnections were drawn up. A sufficiently close coincidence is seen.

When disconnections are distributed among the months of the year (Figure 1), there is also a maximum in June and July; that is, during the period of the most intensive thunderstorm activity. The maximums of the disconnections by hourly intervals (Figure 2) occur the second half of the day (1400-1900 h) and in the morning hours (0500-0700 h). The afternoon maximum is explained by thunderstorm-related disconnections, since these storms are seen most frequently during these hours.

The second surge occurs during the predawn and morning hours. The cause of these disconnections is insulator flashover due to dew formation and insulator chain contamination by birds.

There are also a considerable number of disconnections caused by insulation failure due to increased humidity (above 80 percent), fog, drizzles and rain.

Disconnections caused by the use of equipment of the wrong size and by wind loads close to the design load stand out, particularly for 110-kV lines, the insulation of which is reinforced most intensively by increasing the number of insulators in the chains.

Conclusions

1. Under the conditions encountered in the Moldavian SSR, reinforcing the insulation on 110-kV VL's to 1.8-2.0 kV/cm and on 35-kV VL's to 2.2-2.9 kV/cm improves operational reliability.

The strengthening of VL insulation must be done with insulators that provide the necessary degree of insulation without lengthening the chains.

2. The lengthening of chains as the result of reinforcing the insulation increases the number of VL disconnections under wind loads close to the maximum design load.

3. Washing power-carrying insulation with a high-pressure jet insures reliable VL operation throughout the year.

4. The specific number of disconnections of 35-110 kV VL's on wooden poles during thunderstorms is higher than disconnections on lines on reinforced concrete poles. When there are more than 5 percent metal and reinforced concrete poles present, 100-kV VL's on wooden poles without a lightning protection cable are not lightningproof.

5. VL's must be protected against contamination by birds along their migratory paths.

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ELECTRIC POWER

SEISMIC TESTING FOR ROGUNSKAYA GES'S DAM DESCRIBED

Moscow TRUD in Russian 11 Mar 80 p 4

[Article by Yu. Vyatich, Tadzhik SSR: "An Earthquake Tests a Dam"]

[Text] At 335 meters, the dam of the Rogunskaya GES on the Vakhsh River in Tadzhikistan will be the tallest in the world. It will be built in a zone of nine-ball seismic activity, which is why it is necessary to know before it is erected how this gigantic structure will behave in case of an earthquake.

The seismic platform is a large and complicated structure built especially to simulate subterranean shocks of different magnitude, frequency and duration. On it there sits an absolutely accurate one three-hundredth scale model of the Vakhsh River's canyon. The model itself partitioned the river's bed -- at first glance it is simply a carelessly dumped pile of dirt. However, this is only at first glance. For several days the staff members of the Laboratory for Seismic Stability of Hydraulic Engineering Structures have been stacking this pile -- and it is not dirt, but a special material called rubber concrete -- in order to give it the shape that ideally corresponds to that of the future dam.

Then the experiment began. The dam model underwent hundreds and thousands of shocks generated by the seismic platform. It was shaken and buffeted from all sides by seismic storms such as never have occurred and never will occur in nature. After each series of shocks, special instruments (seismic receivers installed in the body of the minidam) yielded detailed information on the seismic loads in all sections of the structure. These data were then analyzed and incorporated into the calculations and a new series of shocks were administered until a complete picture of the vibrations of the future hydroelectric power station's dam was compiled.

The experiment lasted for about 2 years. What were its results?

"The main thrust of the experiment," says Candidate of Technical Sciences G. Seleznev, chief of the Laboratory for Seismic Stability of Hydraulic Engineering Structures of the Tadzhik SSR Academy of Sciences' Institute of Seismically Stable Construction and Seismology, "was to establish the loads imposed on the dam during different types of earthquakes, determine its dynamic properties -- that is, its elasticity -- and, using the results we obtained, to make recommendations to the planners and builders of the Rogunskaya GES. We fulfilled this assignment."

The research done by the Tadzhik scientists has been included in the program of the Seventh World Conference on Seismically Stable Construction, which will be held in Turkey in September of this year.

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ORU-500 OUTDOOR DISTRIBUTION INSTALLATION PICTURED

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 8 Jan 80 p 1

[Photograph by S. Panova, plus caption]

[Text]

An ORU-500 outdoor distribution installation, which will transfer electricity from three units into Siberia's power system, has been installed next to the Sayano-Shushenskaya GES's dam.

In the pictures, members of G. Potylitsyn's work crew are assembling the ORU-500.

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ELECTRIC POWER

BRIEFS

NIZHNE-ADYCHANSKAYA GES--Almost in the center of Verkhoyanskiy Rayon, not far from the confluence of the Adycha and Yana Rivers, an expedition from the "Lengidroproyekt" institute has arrived to begin working. By winter travel vehicles from the settlement of Batagay and by air, drilling equipment and portable electric power stations have been delivered to the construction site of the future Nizhne-Adychanskaya GES. Drilling into the riverbed has begun from the ice that covers it, as well as the analysis of soil samples from the base of the dam. The capacity of the GES's first stage, construction of which will begin during the 11th Five-Year Plan, will be 300 MW. After completion of the entire hydraulic engineering complex, the electricity production capacity will be almost tripled. [Text] Moscow PRAVDA in Russian 10 Jan 80 p 6] 11746

DNEPROGES-2 COMPLEX GENERATOR--Production of a generator for the Dneproges-2 complex has been completed at the Heavy Electrical Machinery Plant in Khar'kov. Possessing all the virtues of the predecessors in its series, as attested to by the high quality of their performance and failurefree operation at this renowned electric power station, this 105,000-kW unit also has a number of other advantages. Because of the improvement of several assemblies its reliability has increased considerably, thermal losses have been reduced, and its service life between repairs has been lengthened from 3 to 5 years. [Text] [Moscow SEL'SKAYA ZHIZN' in Russian 29 Jan 80 p 1] 11746

SURGUTSKAYA GRES POWER UNIT--The 11th power generating unit at the Surgutskaya GRES has been put under industrial load. The capacity of this electric power station, which operates on byproduct casing-head gas, has now reached 2.234 million kW. It supplies electricity to oil and gas enterprises, as well as the new cities, along the Central Priob'ye. [Text] [Moscow STROITEL'NAYA GAZETA in Russian 25 Jan 80 p 3] 11746

BUREYSKAYA, TOKTOGUL'SKAYA GES'S--The energy potential of the nation of the Soviets is growing from year to year. Units already in existence are being improved and modernized and the foundations are being laid for new ones. The Bureyskaya GES will be one of the most powerful of our electric power stations. Its dam will rise to a height of 142 m in the Talakanskiy range and will be taller than the dams at the Bratskaya, Zeyskaya and Krasnoyarsk a GES's. Its six units will have a total capacity of 2 million kW and will generate more than 7 billion kWh of electricity every year. Right now, surveyors and builders are at work on the banks of this taiga river. They are erecting living quarters, storehouses and moorings. At the same time, the counters at the Toktogul'skaya GES -- the most powerful GES on the Naryn River -- clicked off their third billion kilowatt-hour of electricity almost a month ago. This is how much power the units at the main station in the Lower Naryn chain have produced since the day its first unit began operating. The rapid mastery of its capacities became possible due to the successful filling of the reservoir, where about 11 billion m^3 of life-giving moisture has already been accumulated. [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 5 Jan 80 p 1] 11746

NEW YUSHKOZERSKAYA GES TURBINE--Yesterday a turbine at the Yushkozerskaya GES was set spinning by overflow water from Lake Kuyto, which was then discharged into the Kem' River, a small waterway in the taiga that flows into the White Sea. Over a power transmission line 70 km long, the electricity produced reaches Kostomuksha, where a powerful mining and concentration combine is being built. [Text] [Moscow TRUD in Russian 12 Mar 80 p 1] 11746

TALIMARDZHANSKAYA GRES--The foundations have been laid for the new Talimardzhanskaya GRES in the southwestern part of the Karshinskaya steppe. This thermal electric power station, which has a capacity of 3.2 million kW and is located in an area with the symbolic name "Nuriston" ("Sea of Light"), will begin producing electricity by the end of the 11th Five-Year Plan. [Text] [Moscow IZVESTIYA in Russian 13 Feb 80 p 2] 11746

LAST GENERATOR FOR DNEPROGES-2--Production of the eighth and last generator for the Dneproges-2 complex has been completed by the workers at the Heavy Electrical Machinery Plant in Khar'kov. The new unit, which has a capacity of 105,000 kW, is much more reliable and economical than the units previously produced. Its service life between repairs has been lengthened from 3 to 5 years. The order was filled a month ahead of schedule. This will make it possible for the hydraulic engineering builders to fulfill their obligation -- to put into operation all the units in the station's new section by the 110th anniversary of V.I. Lenin's birth -- successfully. The GES's capacity will then be almost 1.5 million kW. [Text] [Moscow STROITEL'NAYA GAZETA in Russian 27 Feb 80 p 2] 11746

FIRST OIL SHALE PROCESSOR--The world's first power engineering unit for the conversion of oil shale into liquid fuel was tested under production conditions at the Estonskaya GRES. In a condenser inside a huge building, a mixture of steam and gas from the combustible rock is processed into furnace oil. This experimental industrial unit is designed to process 3,000 tons of shale per day. The heart of the distillation section -- a drum-type reaction vessel -- is monitored with the help of hundreds of instruments, the readings of which are displayed at the main control panel. The entire operation is automatic and remotely controlled. A second such unit is planned, after which one of the GRES's power-producing units will be converted to the use of this fuel. The first production cycle lasted 18 hours and was a success, producing about 15 tons of furnace oil. [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 19 Feb 80 p 2] 11746

FUEL FROM OIL SHALE--Not a single tank car of fuel is being sent to the largest power station in the country -- the Estonskaya GRES in Kokhtla-Yarve -- although liquid fuel flows uninterruptedly into the fireboxes of the boilers in one of its power-producing units. This became possible after a new power engineering installation that processes oil shale went into operation. This new installation extracts the most valuable components -- raw materials for the production of synthetic articles -- from the shale. The liquid product remaining after this distillation flows into the boilers' fireboxes through pipes. Equipment utilization efficiency improved immediately. The need for frequent reconditioning of the units passed away, since ash does not form when this liquid fuel is burned, and ash was a by-product that caused much trouble. [Text] [Moscow PRAVDA in Russian 21 Feb 80 p 3] 11746

CSO: 1822

MEASURES TO CONSERVE MOTOR-VEHICLE FUEL

Moscow MATERIAL'NO-TEKHNICHESKOYE SNABZHENIYE in Russian No 2, Feb 80 pp 40-42

/Article by L. Yakovlev, Chairman of the Central Committee of the Union of Motor-Transport and Highway Workers: "Motor Transport to Save on Fuel"/

/Text/ Problems of economizing on fuel and energy resources are constantly at the center of attention of trade-union organizations. These problems are regularly considered at workers' meetings and at sessions of the trade-union committees. The discussion has been preceded by a great deal of analytical work at motor-vehicle enterprises and combines. Therein advanced experience is pooled, shortcomings are revealed, and measures to eliminate them are planned. Guided by the decisions of the November 1979 Plenary Session of the CPSU Central Committee, as well as by the decrees of the CPSU Central Committee and the USSR Council of Ministers on improving the economic mechanism, the groups of the Moscow motor-vehicle enterprises are intensifying the struggle to conserve fuel resources and to completely utilize existing reserves. The groups at such enterprises and organizations are conducting multi-faceted work with regard to economizing on petroleum products. Greater and greater scope is being attained by socialist competition, "raids" to check up on fuel expenditures, contests for the best efficiency experts' suggestions and inventions, and the dissemination of progressive innovations. These labor groups participate in the All-Union Public Review of Effectiveness in Utilizing Raw Materials and Fuel and Energy Resources. All this is yielding substantial results.

A significant contribution to the common savings "coin-box" is being made by Mosavtolegtrans (Moscow Motor-Vehicle Passenger Transport Service)--the country's largest motor-vehicle transport association. At the present time it includes 26 specialized motor-vehicle enterprises, having 24,000 motor vehicles at their disposal. Every day taxis issue forth from the gates of the motor pools and motor-vehicle combines, rushing to pick up visitors to the capital as well as its inhabitants. The main-line mini-buses of RAF (Russian Motor-Vehicle Federation) /not verified/ drive out in various directions along their assigned routes. More than 6,000 motor vehicles race toward the buildings of ministries, departments, and other institutions.

The demand for taxi transportation and departmental service is growing constantly. Under these conditions the operational mileage of motor vehicles is increasing substantially. Thus, the average annual operation of a taxi amounts to 70--85,000 km, while that of a motor vehicle in departmental service is 30--35,000 km. The total annual mileage of the administration's motor-vehicle pool amounts to almost 1.5 billion km. The expenditure of gasoline reaches 160,000 tons, while that of engine oil is more than 2,000 tons.

The figures cited above testify that Mosavtolegtrans is a major consumer of gasoline, fuel and lubricating materials. Because they understand this, the administration's group is conducting a great deal of work with regard to the economical and efficient utilization of fuel and energy resources. As a result the annual savings are equal to 9,000 tons of gasoline and hundreds of tons of engine oil. Such results have been achieved by means of increasing the effective utilization of rolling stock, increasing the proportion of its useful operation, and reducing operational expenditures.

It is far from simple to reduce operational expenditures. With the increase of prices for fuel and lubricating materials the expenses of motor-vehicle systems have grown. Last year for the administration as a whole they almost doubled (as compared with 1977). Nevertheless, if we operate economically, we can find ways to reduce expenditures. For example, good results may be obtained by re-examining the norms of expenditure, as well as by promulgating specific measures aimed at improving the motor pool's technical condition.

Let's examine each of the facts mentioned above in detail. First let's speak about norms. More progressive norms have been introduced, i. e., relative norms for the expenditure of fuel per unit of transport operation. Such relative norms were worked out on the basis of linear norms with the aid of a coefficient of the motor vehicles' paid mileage. And the greater this coefficient, the less the relative coefficient and the greater the effect of actual savings. Thus, to fulfill the 1979 plan indicators, the administration established an estimated coefficient of paid mileage of 0.746. In practice it turned out to be somewhat higher--0.776. And this alone accounted for the fact that in the first six months more than 5,000 tons of gasoline were conserved, or 5.8 percent of the linear norms.

Another no less important reserve for conservation is the observance of the system of technical operation of the rolling stock. And this is understandable, for the slightest maladjustment greatly increases fuel consumption. So , reducing the air pressure of the tires of passenger cars by 20 percent as compared to the norm increases fuel consumption by 15 percent. When there is misalignment of the front, wheels, tightened brakes, running gear bearings and transmission in the motor vehicles, fuel expenditures increase by 10--15 percent. Improper adjustment of the fuel-injection and ignition systems increases gasoline consumption by 15--25 percent.

Our task consists of not only not allowing over-consumption but also of significantly reducing consumption and thereby assuring substantial conservation. And herein we are aided by coordinated work with regard to raising the level of motor-vehicle technical operation, based on improving the quality of preventive maintenance and repairs. We need to pay more attention to monitoring the technical condition of the rolling stock, and, above all, to the systems of fuel injection, ignition, and exhaust.

At the present time Mosavtolegtrans's motor-vehicle enterprises have mechanized technical-service assembly lines, fitted out with up-to-date hoisting and conveying equipment, approximately 50 brake stands and more than 60 stands for checking and adjusting wheel alignments, as well as 43 units for over-all checks on fuel-injection and ignition systems.

Each enterprise has specialized units for diagnostics and control.

The extensive utilization of precise diagnostic and garage equipment in the technical servicing and repair of motor vehicles ensures Mosavtolegtrans of great savings on fuel and lubricating materials. For example, just the introduction of units to check out motor-vehicle safety systems allows motor-vehicle enterprises with a pool of 1,000 motor vehicles to save as much as 29,000 rubles a year.

The fuel economy of a motor vehicle may be determined not only by direct measurement of the fuel consumption but also by indirect parameters. One such parameter is the volumetric content of the carbon monoxide portion in the exhaust gases. Over the course of several years Mosavtolegtrans in conjunction with the Scientific-Research and Design-Technological Laboratory of Engine Toxicity (NILTD) has has conducted work on reducing the toxicity of exhaust gases by means of monitoring and adjusting the engine carburation systems. It has been established that the average carbon monoxide content in exhaust gases when the engine is idling amounts to 5.5 percent, and after adjustment it is 2.2 percent. Moreover, the relative norm of gasoline consumption per motor vehicle is reduced from 0.8 to 0.72 kg. per hour. Adjusting the engine for Moscow conditions becomes all the more necessary in that as much as 35 percent of the time the motor vehicles are idling.

In order to bring about a more effective reduction in the toxicity of exhaust gases and to improve angine fuel economy, the check-up and adjustment for carbon monoxide content are carried out for TO-1 and TO-2. Herein it is mandatory to take into consideration the air temperature and the atmospheric pressure. The results of these check-ups are reflected in journal reports. Such records have become particularly important. They may represent the right to drive out, if all the systems of a vehicle are operating correctly, and if all defects have been eliminated. Putting a motor vehicle onto the line is prohibited unless the data of the check-ups correspond to the established norms and standards. The results of the check-ups are summarized and analyzed for all the motor-vehicle enterprises. This aids us in establishing in which sectors the work has been well-organized and in determining higher end results.

A great deal of attention within the administration is paid to the economical and efficient expenditure of lubricating materials. With this goal in mind, a centralized oil system was created, as well as units for collecting used oils. All the lubrication units have been fitted out with special equipment, thanks to which a high level of mechanization has been achieved and losses almost eliminated. Out of the 2,163 tons of engine oil used per year 572.5 tons have been recycled by means of the centralized system. This amounts to 165 percent of the established plan. Moreover, we have succeeded in increasing the conservation of lubricating materials thanks to the introduction of the new NAMI-VG-10A filtering element for the engine's lubrication system. In comparison with filters used previously, this filter possesses a number of operational advantages, and it costs less. Improved filtration allows for less frequent oil changes in the engine's crankcase. Because of this for three years of the 10th Five-Year Plan savings of more than 630 tons of oil were made, amounting to a sum of about 500,000 rubles.

The administration has also conducted a great deal of work on improving normative-technical documentation, regulating accounts, storage, and effective utilization of fuel and lubricating materials. The Instruction which has been worked out with regard to receiving, storing, and accounting for fuel and lubricating materials in Mosavtolegtrans's motor-vehicle enterprises and the supplements to it are directed at strengthening the conservation system. They have also specified the modus operandi with petroleum products. Accounts of gasoline consumption are kept for each motor vehicle and driver. Coupons for fuel are issued only upon fulfillment of the shift assignment. Each month accounts are made of the actual fuel remnants.

Fuel economy depends to a large extent on the skills of the drivers. At the present time the fuel economy of a motor vehicle can be improved by 25 percent by means of observing systems of linear operation and driving skills. Therefore, regular classes with the driving personnel have been organized at Mosavtolegtrans's enterprises. Out of the 39,000 drivers of Mosavtolegtrans more than half have qualified as first- or second-class operators. Some 1200 drivers raise their vocational level every year. The advanced experience of drivers who have attained large fuel economies is widely disseminated throughout all the production groups.

The administration's group is conducting coordinated work on conserving fuel and energy resources. Questions of economizing are regularly considered at Party and trade-union meetings. Here they listen to the reports of individual enterprises, results of socialist competitions are summed up, and prizes are awarded. Mosavtolegtrans takes part in the municipal contest-review on fuel economy which is held among the capital's transportation enterprises. According to the results of the first round the administration won second place. The best results in conserving fuel and lubricating materials have been achieved by the drivers M. V. Korzhikov (taxi motor pool No. 7), V. G. Parshenkov (taxi motor pool No. 16), G. K. Alekseev (taxi motor pool No. 18). A substantial contribution to economizing and conservation has been made by the repair-service efficiency experts P. I. Morgachev (taxi motor pool No. 1) and A, I. Pozdnyakov (taxi motor pool No. 8).

It should be stated that the Mosavtolegtrans group is not satisfied with the results which have been achieved, and it is striving to further strengthen the conservation system. But, unfortunately, a more complete utilization of the existing reserves depends not only on it. Just take the equipment designed for testing the adjustment of the fuel fitting. It is still being turned out in an obsolete model and does not meet up-to-date requirements. To the present day scientifically grounded methodological developments for operating the fuel apparatus of carburator engines have not been approved. Moreover, they would facilitate, to a large degree the effective utilization of existing diagnostic equipment.

It is well known that no kind of technical-service system can ensure a higher level of reliability than the level inherent in the given design of a motor vehicle. In this connection it should be noted that despite the improved design of the GAZ-24 motor vehicle and its modifications, expenditures for technical services have still remained significant. Thus, the proportion of expenditures for technical services and minor current repair of passenger cars amounts to 12--15 percent of the total outlays for maintenance and operation. It is also appropriate to pose the question of improving the fuel economy of taxis. The elimination of existing shortcomings, the correct solution to the problems of supplying spare parts, will allow the motor-vehicle transport workers to attain more tangible results in conserving petroleum products. And this is of enormous importance to the national economy.

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FUELS

YATROV DISCUSSES FUEL-ENERGY COMPLEXES

Moscow EKONOMICHESKAYA GAZETA in Russian No 10, Mar 80 p 10

/Article by S. Yatrov, Director of the All-Union Scientific Research Institute for Complex Fuel-Energy Problems under USSR Gosplan, Doctor of Technical Sciences, Professor: "The Fuel-Energy Complex"/

/Text/ The Soviet Union possesses the world's largest fuel-energy complex. Its sectors are developing at a rapid rate. During the past 15 years alone electric power production and oil drilling (including gas condensate) almost tripled, while gas production more than quadrupled. However, as L. I. Brezhnev noted at the November 1979 Plenary Session of the CPSU Central Committee, it is a strain to satisfy the growing requirements of the national economy, and we need to think through again and again the entire complex of energy problems. Ranking high among the latter is the problem of a balanced development of the fuel-energy complex and that of the national economy as a whole.

Its Role in the Reproductive Process

The fuel-energy complex (TEK) comprises the aggregate of enterprises, installations, and structures which furnish the extraction and processing of primary fuel-energy resources, as well as their transformation and delivery to consumers in a form which is suitable for use.

The complex's principal task is to effectively furnish high-quality energy for the country's needs. This assumes a close dependence of the complex's development on the scope, structure, and growth rate of the entire national economy. TEK also has a great influence on the effectiveness of social production. It is primarily a matter of the level of the power-worker ratio, and, consequently, also of labor productivity, which is important for all the sectors of the economy. The fuel-energy complex also influences the processes of production concentration and specialization, as well as the territrial division of labor. At the same time the complex's growth rate and structure depend, to a large extent, on the sectors which form its material-substantive content, especially on power machine building, ferrous and non-ferrous metallurgy, the chemical industry, and the construction industry.

The interdependence between the development of the fuel-energy complex and that of the national economy as a whole, their correlative ties, reflect the correlations between the growth of the national income and the volume of the fuel-energy resources being used:

Average Annual Growth Rates
(in percentages)

	Consumption of Energy Resources (including exports)	National Income	Coefficient of Elasticity
1961--1965	6.6	6.5	1.02
1966--1970	4.8	7.8	0.62
1971--1975	5.1	5.7	0.89
1976--1978	4.8	5.1	0.94
1961--1978	5.4	6.4	0.84

The ratio of the growth percentage of energy-resource consumption to the growth percentage of the national income does not, of course, mean that the movement of one of these indicators completely determines the dynamics of the other, but it does testify to the definite tie (elasticity) between the growth of the national income and the growth in the consumption of energy resources through a series of intermediate links.

It is also obvious from the table that for every percent of growth in the national income during the period 1961--1978 there was an increase of 0.84 percent in the consumption of fuel-energy resources. Consequently, a growth in the national income is ensured by the development of an economy which is energy-saving in its nature. In order to reinforce this trend, we must speed up the replacement of obsolete, extremely energy-consuming equipment and the use of energy-saving technology, increase the thermostability of industrial buildings and apartment houses.

The sectors of the fuel-energy complex, along with metallurgy and machine building, belong, as is known, to those branches of industry whose steady, balanced growth is a foundation of the economy. An idea of the importance and the place of the TEK in the reproductive process is provided by the following data (1978):

		Including	
Proportion (in percentages)	Fuel-Energy Complex	Electric-Power Engineering	Fuel Industry
in the total volume of industrial output (in wholesale prices of the enterprises as of 1 January 1980)	9.1	3.3	5.8
in the cost of industrial-production assets	29.1	16.2	12.9
in the total capital investments in industry	29.6	8.6	21.0

As the data of this table testify, a high degree of output-capital ratio and capital-output ratio is characteristic of the sectors of the fuel-energy complex. Moreover, if the entire share of capital investments in the complex within the total volume of capital investments comprises 29.6 percent, it is 8.6 percent in electric power engineering, 4.5 percent in the coal industry, 11.6 percent in the petroleum industry, and 4.9 percent in the gas industry.

The following amounts are expended directly or indirectly on the development of TEK: 65 percent of the pipes produced in the country and as much as 20 percent of the remaining output of ferrous metallurgy, 15--20 percent of the copper and aluminum, 13--16 percent of the cement, and 1/6 of the total output of machine building. The proportion of the cost of the fuel and energy participating directly or indirectly in the cost formation of the consumption fund, in our opinion, is equal to approximately 14.1 percent.

Fuel freight comprises about 40 percent of all railroad hauls. In the future in connection with the technical retooling of the TEK sectors, the absolute growth in the production volumes of fuel-energy resources, and the considerable worsening in the natural conditions of their development, the demands on the quantity and quality of the material and technical means being supplied to the complex's sectors will grow even greater.

From the foregoing statements it becomes obvious how important it is for the national economy to have an increased effectiveness of production in the TEK sectors, as well as conservation and efficient utilization of fuel-energy resources.

In order to establish grounds for the needs for fuel and electric power, it is extremely important to establish absolute indicators for the energy capacity of the national income and the aggregate social output. These

These indicators are determined based on the consumption of fuel-energy resources within the country for productive and non-productive needs (in kilograms of conventional fuel per ruble of national income and output):

Indicators of Energy Capacity	1965	1970	1975	1978
Energy Capacity of the Total Social Output	2.02	1.76	1.63	1.60
in percentages of 1965	100	87.10	81.09	79.31
Energy Capacity of the Utilized National Income	4.51	3.96	3.91	3.87
in percentage of 1965	100	87.99	86.84	85.95

The energy capacity of the utilized national income is decreasing, as is obvious from the table, more slowly than the energy capacity of the total social output. This is linked with the lowering of the proportion of the cost of the utilized national income in the aggregate social output, and with the growth of the material consumption of social production. The reduction of the energy capacity of the national economic end result depends on lowering the material consumption of production and particularly that of construction. The main thing is to introduce progressive technology, improved equipment, and lighter-weight structural components. The given circumstance once again emphasizes the urgency of a multilateral strengthening of stimulating factors to reduce material outlays.

Structural Shifts

An increase in the effectiveness of the fuel-energy complex is linked with structural shifts in the production and consumption of fuel-energy resources.

In connection with the need to gain time to speed up the development of chemistry and the other energy-consuming sectors, the formation of the country's fuel-energy balance has proceeded with a constantly growing proportion of petroleum and gas within the total production of primary resources. Furthermore, as may be seen from the table below, which characterizes the structure of fuel-resource production, there has been a significant decrease in the proportion of coal (in its percentage of the total volume of the production of primary fuel resources):

Years	Petroleum	Gas	Coal	Miscellaneous Types of Fuel (Peat, Shale, Wood)
1960	30.5	7.8	53.9	7.8
1965	35.8	15.5	42.7	6.0
1970	41.1	19.1	35.4	4.4

1975	44.7	23.2	29.0	3.1
1978	45.7	24.6	27.2	2.5

As a result the proportion of petroleum products in the over-all structure of fuel production increased from 30.5 percent in 1960 to 45.7 percent in 1978.

In accordance with this there was also an increase in the proportion of fuel oil in the structure of fuel consumption by the country's electric power stations:

Years	Total	Including			
		Coal	Gas	Fuel Oil	Miscellaneous
1965	100	56.5	20.8	11.9	10.8
1970	100	46.7	22.7	22.1	8.5
1975	100	43.5	22.0	27.1	7.4
1980 (Plan)	100	40.0	25.0	29.3	5.7

The increased scope of our economy, the growth of demands for products whose basic raw material is petroleum, the rise in the technical level of the extracting sectors, and the utilization of new sources of energy have brought about the need and created the possibility of accomplishing a turnabout and a re-orientation in developing the sectors of the fuel-energy complex. L. I. Brezhnev pointed out the following: "With regard to the 1980's, our task will consist of substantially improving the country's fuel-energy balance and, in the first place, to reduce the proportion of petroleum as a fuel for electric power stations." The principal ways of solving this problem were pointed out at the November 1979 Plenary Session of the CPSU Central Committee.

In the Interests of the Future

First of all, we must significantly increase the rate of gas extraction, particularly in Western Siberia, and ensure on a wide scale the replacement of fuel oil by gas in fuel resources.

The replacement of petroleum by other types of fuel, of course, will not mean that there will be a reduction in its extraction. On the contrary, the value of this resource determines the ever-growing scope of increasing its explored reserves, primarily in Western Siberia, and their extraction.

The universal development of nuclear-power engineering, and not only for the needs of heat engineering, will become an important trend in the formation of the fuel-energy balance. In the distant future it is precisely nuclear-power engineering which will resolve the problems of supplying the national economy with electric power and thermal energy. As is known, during the last few years the average annual growth rate in the consumption of electric power has slowed down. If during the period 1961--1965 it outstripped the growth rate of the national income by a factor of 1.8, in 1970--1975 it was only a factor of 1.23, and in 1976, while from 1976 to 1978 there was no outstripping at all.

In the interests of the future, as L. I. Breshnev has noted, prospective plans should provide for the extensive construction of nuclear electric-power stations with fast breeder reactors, the inaugeration of work on thermonuclear fusion, the production of synthetic liquid fuel, and the utilization of geothermal and solar energy.

And, finally, even today the speeded-up attraction into economic circulation of the Ekibastuz, Kansko-Achinsk, and Kuznetsk Fuel-Energy Complexes, the specially built thermal electric power stations based on coal, will make an extremely substantial contribution to the effectiveness of production in the sectors of the fuel-energy complex.

In guaranteeing energy resources to the national economy amid the increasing scope of their consumption exceptional importance attaches to a system of savings, of conserving heat and energy.

The implementation of the planned program for developing the fuel-energy complex is possible, naturally, under conditions of complete balance, both intra-sectorial and intersectorial. Therefore, improving the structure of the administration of the fuel-energy complex as an integrated economic organism is a top-priority task. In our opinion, it would be expedient to work out a general scheme for administering the complex, to provide within it for more effective solution within a centralized system of inter-sectorial problems and the creation of inter-departmental organs in major regions in which the All-Union fuel-energy bases are situated.

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FUELS

GOSPLAN OFFICIAL REVIEWS WEST SIBERIAN OIL, GAS COMPLEX

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 3, Mar 80 pp 19-26

[Article by V. Filanovsky, chief of USSR Gosplan department]

[Text] The Western Siberian oil and gas complex is taking shape on the area of the Western Siberian lowland, which occupies approximately one-tenth of the entire territory of the Soviet Union and extends from the Urals to the Yenisey River and from the Arctic Ocean to the Altay Mountains and Kazakhstan. An area of 1.5 million km^2 is promising for oil and gas. The complex is now understood as the territory of Tyumenskaya and Tomskaya oblasts, where the oil and gas industry emerge as the determining branches while geology, construction, transport and power engineering are the accompanying branches, without which oil and gas production cannot be developed. The main designation of the complex is to provide the country's ever-increasing need for oil and gas.

It was noted in L. I. Brezhnev's speech at the 28th Komsomol Congress that "We will count on achieving the main increase of oil and gas production and the valuable chemical raw material produced from them during the next decade mainly because of Tyumen'. In this regard a new, more complex stage of development of Western Siberia is beginning or rather has already begun."*

The path to Siberian oil and gas was long and difficult. As early as 1932, Academician I. M. Gubkin advanced the hypothesis of the possible existence of oil and gas fields in the Western Siberian lowland. However, subsequent geological prospecting operations did not confirm this prediction for a long time. Only on 23 September 1953 was Siberia's first gas gusher struck from the test well near Berezovo. The first oil gusher was produced in 1960 near Shaim. The gas and oil at Berezovo and Shaim, although they confirmed the hypotheses of the oil and gas content of this region, were produced from pools with small commercial reserves.

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* L. I. Brezhnev, "Leninskim kursom" [On Lenin's Course], Vol 7, Moscow, Politizdat, 1979, p 287.

The oil and gas content of the greater part of the Western Siberian lowland was proved in 1961. By the end of 1966, six oil and gas-bearing regions had been determined within the lowland. Only five years ago the boundary between regions with prevalent oil and gas reserves was traced along the 64th meridian. A zone of oil fields lay to the south of it and a zone of gas and gas condensate fields lay to the north. Many scientists assumed that there were no oil fields north of the given latitude. However, this erroneous assumption was rejected by the results of prospecting operations during the 10th Five-Year Plan. Even now oil fields--Kholmogorskoye, Muravlenkovskoye, Tarasovskoye and others--have been discovered in northern Tyumenskaya Oblast.

The Western Siberian complex was developed and is being developed under very complex conditions. They include remoteness--1,000-1,500 km from the industrially developed regions, a severe climate, a practically complete absence of effective year-round transport routes, low population and so on.

Following the first finds of the Tyumen' geologists, among which are the Samolor oil and the Urengoy gas fields, tens of other fields were discovered. This large and reliable raw material base was the basis for the 24th CPSU Congress raising the problem of developing the country's new oil- and gas-producing base in Western Siberia. This problem has been solved successfully. It is planned to produce oil and gas in the amount of 315 million tons and 163 billion m^3, respectively, which comprises approximately 50 and 37 percent of their total All-Union production by 1980 in Western Siberia.

This success did not come by itself. The enormous efforts of the entire country were required to achieve it. The labor of the geologists, builders, oil workers, gas workers, transport workers and many other specialists who developed a complex with an important industrial potential, providing the country with the most valuable types of fuel and chemical raw material, is truly heroic.

In 1966 a group of petroleum specialists and businessmen from the United States and Canada completed a trip through Western Siberia. Having flown around the limitless swamps, marshes and lakes where it was planned to develop future oil fields, cities, electric power plants and other objects, they stated that our plans to develop a large oil-producing base here within short deadlines are utopian and that there are neither the forces, funds, nor special technology to develop this complex region. However, the initial plans were actually overlapped many times. Western Siberia is now a vast industrial region where the cities of Surgut and Nizhnevartovsk with population of more than 100,000 persons, Nefteyugansk with population of more than 50,000 and also Strezhevoy, Uray, Nadym and others have been built and are continuing to grow. The complex has long been provided with electric power from the Surgutskaya GRES, which operates on casing-head gas, whose capacity today is 2.5 million kW and which will increase to 6.2 million kW by 1985. A railroad which links Tyumen' with Surgut and Nizhnevartovsk, which will be brought to Urengoy in 1982, is now operating.

Let us trace the main stages in development of the Western Siberian complex and let us attempt to make some conclusions. After all, this complex is now one of the leaders in the economy of our country and large capital investments and material and technical resources are being sent here. Thus, more than 22 billion rubles of capital investments will be assimilated here during the 10th Five-Year Plan. Almost eight million rubles' worth of construction and installation work is carried out daily at objects of the leading sectors of the complex alone. Under these conditions, making any non-optimum solution leads to large unjustified expenditures.

Life in the oil and gas regions begins with the arrival of geologists and prospectors. As was indicated above, the Tyumen' Geological Administration enjoyed great success in the 1960s. By the end of the Eighth Five-Year Plan, the discovered oil reserves made it possible to note in the Directors of the 24th CPSU Congress the task of bringing oil production in Western Siberia up to 120-125 million tons in 1975.

The Eighth and Ninth Five-Year Plans were characterized in the field of geological prospecting work by stability in territorial distribution and volumes of drilling. Without negating the importance of the work done by the geologists, it must be noted that an error was committed even then--the volumes of test drilling, especially of exploratory drilling, essentially did not increase for many years. Self-complacency began both at Mingeo [Ministry of Geology] of the RSFSR and Mingeo of the USSR and in planning bodies. The Tyumen' geologists consolidated themselves in their base villages and delayed in going out to new regions of the complex for at least 5-7 years. The material and technical base of the geological organizations was also developed unsatisfactorily during the last few years; therefore, the expeditions and associations did not have good repair shops, garages, supply bases and so on.

It became clear that geological prospecting work must be stepped up immediately (otherwise it may go beyond the bounds of the recommended ratio of known reserves and the volumes of oil production); but it was impossible to sharply increase test drilling operations. With planned test drilling of 1,086,000 meters for 1979 through Glavtyumengeologiya [Main Tyumen' Administration of Geology] for 1979, fulfillment of the plan comprised 763,000 meters.

There are no problems with provision of known gas reserves for the gas industry today and for the future. This of course does not mean that gas prospecting can be reduced, but an increase in improvement of oil prospecting requires special efforts. Moreover, a break in the given problem must be achieved during the next two years.

This problem is essentially not extremely complex. The necessary amount of general-purpose equipment and special equipment, construction materials and especially of prefabricated production buildings of assembled steel sections must be allocated for successful solution of it. But the problem cannot be solved only by an increase of resources. The Tyumen' and Tomsk geologists should carry out serious work to improve the technical and economic indicators in drilling, which not only did not increase but even deteriorated during the past few years, which is obvious from the given data on Glavtyumengeologiya.

Table 1.

	Year		
	1975	1978	1978 in percent of 1975
Drilling rate, meters, per rig per month	1,230	1,005	81.7
Length of constructing a single well, days	155.8	216.5	139.0
Drilling per drilling rig, m/year	3,755	3,306	88.0
Labor productivity in drilling, m/man	44.5	37.3	83.8

If one talks about the overall organization of drilling operations in Western Siberia, one must note that the volume is small, while the degree of exploration of this region is significantly below that of many other regions of the country, although the potential resources here are greater.

The first commercial oil of Western Siberia in the amount of approximately 200,000 tons was shipped by tankers to the Omsk Petroleum Refining Plant in 1964, while the first major oil pipeline with length of 410 kilometers from the Shaim group of wells has been operating since 1965. The first oil pipeline from the regions of the Central Ob' (Ust'-Balyk-Omsk) was put into operation by the 50th anniversary of the Great October Socialist Revolution. Since then three additional pipelines have been constructed to the west and east, although the fields of Western Siberia are still experiencing difficulties with oil transport since construction of major oil pipelines systematically lags behind the needs of the petroleum industry.

The intensity of each period in the development of the Western Siberian complex was caused by its own special conditions. Thus, tens of problems which arose during development of the complex had to be solved simultaneously with development of new fields during the period 1966-1975. Due to an absence of a railroad, most work was seasonal in nature since river transport was unable to deliver all the required cargo during the short navigation season. So-called wintering-over structures (ice routes) were built, aviation was brought in extensively, but even so the idle times and losses of time due to untimely delivery of cargo were high. The absence of electric power forced construction of tens and hundreds of small electric power plants locally, while the most complicated process of drilling oil wells had to be carried out on diesel drive. This lag in development of the infrastructure of the complex led to unjustified expenditures of significant state funds. Unfortunately, there is no generalizing accounting of similar expenditures. One can cite only one example. The lag in construction of LEP [Overhead power transmission line] of 220/500 kW from Tyumen' to Surgut led to a reduction in cost equal to that of the entire LEP for two years.

Returning to problems of oil production, it should be noted that tens of purely engineering and technological problems had to be solved during the initial period since the operating experience of other oil regions could not be entirely transferred to the complex, which has no analog by its conditions either in our country or in the world. One can say to the owner of the oil and gas workers, builders and all who develop this region, that the procedures, methods and technology which most closely correspond to the characteristics of the region were worked out here within an amazingly short deadline.

The increase of oil production volumes in Western Siberia proceeded at fast rates, which is obvious from Table 2.

Table 2 (in million tons).

Increase of Oil Production, Including Gas Condensate	Years		
	1965-1970	1971-1975	1976-1980
Throughout the USSR-total	109.7	138.1	115.2
Throughout Western Siberia	30.4	116.4	163.6

The main characteristic in development of oil production in Western Siberia during the Eighth and Ninth Five-Year Plans was the fact that a small number of the most productive fields, the number of which comprised 20 in 1975, participated in the development. The Samotlor field, which played an important role in the country's total economics during the past decade, occupied a special position in the country's petroleum industry. The first oil was produced at Samotlor in 1969 and the fraction of the total All-Union oil production was 17.7 percent at the end of the Ninth Five-Year Plan. The significance of Samotlor is also high during the 10th Five-Year Plan, but this field has already been essentially brought up to its maximum level and the increase of production for it will comprise only five million tons in 1980.

Due to the fact that highly productive fields were brought into development during the Eighth and Ninth Five-Year Plans, the increase of oil in Western Siberia was achieved with leas expenditures of material resources and capital investments, which had a positive effect on all the technical and economic indicators of the sector.

As is known, one of the main indicators which formulate expenditures in the petroleum industry is the average yield of a new well. It is adequate to say that a reduction of average yield by one ton throughout the country as a whole during the decade requires additional capital investments of one billion rubles.

Whereas the increase of oil production was achieved in previous years due to the Samotlor field and a small number of other fields, more than 35 new fields must be brought into exploitation during the 10th Five-Year Plan, especially during the last three years (1978-1980). A decrease of the average yield of new wells led to the need for rapid growth of the volumes of exploitation drilling, which is obvious from Table 3.

Table 3.

	Year		
	1975	1978	1980 (Planned)
Average daily yield of one new well, tons/day:			
throughout the USSR	58.5	48.4	45.0
throughout Western Siberia	162.0	90.6	71.1
Volume of exploitation drilling for oil, thousand meters:			
throughout USSR	8,768	11,576	17,160
throughout Western Siberia	2,735	5,045	9,580

The characteristic feature which complicates the increase of drilling operations is the dispersion of new fields and remoteness from supply bases and industrial enterprises by 200-300 kilometers. At the same time the difficulties of the first period of development are being repeated to some extent. The program of going out to new fields is not being fulfilled during the 10th Five-Year Plan. The main reason for this is the lack of preparation of the fields from aspects of the development. The planned volumes of drilling operations cannot be realized without construction of access roads, delivery of electric power and creation of production bases. The 1979 plan for exploitation drilling has been fulfilled by only 82 percent.

There are also serious deficiencies in the work of the oil personnel themselves during the current five-year plan. The number of wells among the so-called low-yield stock is high. Their potential is far from being completely utilized. Several additional thousand tons of oil per day could be produced if they were supplied with new equipment, if they used leading technology and if organization of labor at these wells was improved.

The petroleum industry of Western Siberia should provide a further increase of oil production during the 11th Five-Year Plan by putting a large number of new fields into operation. This requires an increase in the volume of exploitation drilling almost 2.5-fold compared to the current five-year plan. Measures should be implemented for leading development of fields, i.e., development of roads, construction and repair bases, electric power transmission lines and other objects, in fundamental improvement of the organization of operations, a significant increase of the drilling rate and further supplying of the drillers with the most modern equipment.

The beginning of development of Western Siberia's gas resources dates to 1963, but main organization of operations occurred in the 1970s. Northern Tyumenskaya Oblast became a unique natural gas storehouse as a result of prospecting work. The characteristic feature of the given region is the large concentration of reserves. There is no doubt that we will witness discoveries of new gas fields in the next few years. The guarantee of this is the fact that the degree of study of promising regions of northen Tyumenskaya Oblast by deep drilling is comparatively low and comprises 0.6 m/km^2, i.e., 17 times less than in the European regions of the country.

An extensive gas pipeline system to the Urals and the European SSR, through which 148 billion m^3 of gas will be pumped in 1980, has been constructed in Western Siberia during the past few years. Worldwide practice has no similar experience in construction of large-diameter major gas pipelines extending more than 3,000 kilometers.

Western Siberia's gas fields are being developed on the basis of the most modern and efficient technological solutions. The use of new principles of well dispersion permitted significant simplification and reduction in cost of developing the gas fields.

Problems of developing the fields were simpler to solve during the first stage of development of the gas industry of the complex than in the petroleum sector. The main problem was development of major gas transport routes, since 70 percent of the country's gas reserves are located in Western Siberia and 80 percent of its consumption is in the European part and in the Urals.

The needs of the national economy place new, more complex tasks in development of the gas industry. Along with significant expansion and acceleration in construction of major gas pipelines and compressor stations, a large volume of work should be fulfilled to develop complex gas preparation installations, separator compressor stations, gas cooling installations, construction of a road network and so on should be fulfilled. The gas workers of the complex are faced with the responsible task of developing a subsector for production and transport of gas condensate. Condensate is a most valuable raw material for the petroleum refining and petrochemical industries. Despite the presence of rather large known reserves and an increase of them during the 11th Five-Year Plan, little has been done until now to develop these reserves.

Development of the oil and gas industry of Western Siberia is entering a qualitatively new period related to the increasing expenditures of all types of material and technical, financial and labor resources required for development and putting into operation a large number of new fields. Economic development of the northern regions of Tyumenskaya Oblast is required. The volumes of drilling operations, capital construction and freight shipments will increase 2-2.5-fold compared to the current five-year plan. The gas sector is faced with sharply increasing gas production during the next 10 years.

The problem of organizing effective administration of the Western Siberian oil and gas complex arises under these conditions. The sector form of administration of the complex during the first stages yielded positive results, making it possible to solve the problem of accelerated development of the oil and gas industry, electric power engineering and transport. This principle has already outlived itself at the current stage and is generating numerous undesirable phenomena.

The country is directing a large number of material resources and equipment, both general-purpose and special-purpose, annually to development of Western Siberia. A considerable stock of diverse equipment, mechanisms and so on has been accumulated during the past few years. However, it is practically impossible to accomplish by these resources any maneuver in the interests of solving the primary operational problems because of agency separation. This separation also leads to the fact that, instead of large repair enterprises and construction industry bases, each agency organizes construction of its own small objects, which leads to dispersion of funds and unjustified additional expenditures. Attention was turned to these serious deficiencies in L. I. Brezhnev's speech at the 25th CPSU Congress.

One must essentially consider the problem of management of the Western Siberian complex. Obviously, one should find the form of management which would contribute most to effective development of the entire region, permitting timely solution of intersector problems.

Much is also validly said about the fact that the complex should be developed only on the basis of using the most modern technology, machinery and equipment adapted to operation under Siberian conditions. However, this technology has not yet been created. For example, trucks, tractors and truck tractors produced serially for the entire Soviet Union are used as transport facilities in Western Siberia. This leads to the fact that most machines and mechanisms occupied in construction of oil and gas pipelines operate a total of 5-6 months per year. In regions where more than 80 percent of the area is occupied by swamps, the objects are separated from each other by tens and hundreds of kilometers and the cost of constructing one kilometer of highway reaches 700,000-1,000,000 rubles and it is extremely difficult to carry on the work without specialized equipment.

The machine builders find themselves in debt to the oil workers in the Given problem. Little has been done by the State Committee for Science and Technology, which has been called upon to head the solution of similar problems. Each sector is now left to its own devices in the field of developing new technology. Thus, Minneftegazstroy, despairing of receiving special equipment from the machine builders, began to design it and manufacture experimental specimens through their own efforts. Much has already been accomplished in this direction, but there now arises the problem of serial manufacture of the product.

One of the important problems is to reduce the cost of constructing industrial and civil projects. Whereas the increase in the cost of construction in Western Siberia of more than twofold compared to the European USSR was explained primarily by the absence of transport communications, the time has come to carefully analyze the causes for the continuing increase in the cost of construction when the railroad has arrived at Surgut, Nizhnevartovsk and otherpoints.

From the very beginning of organizing oil and gas production when it became clear that Western Siberia has large hydrocarbon raw material resources at its disposal, local party and Soviet bodies repeatedly raised the question of working out a long-term (for 15-20 years) complex plan for development of the Western Siberian complex. However, this plan does not yet exist. But the need for it is obvious. Development of the complex is being delayed by the increasing disproportion between the achieved high levels of oil and gas production and development of related and auxiliary sectors participating in development of the material and technical base of the oil and gas industry. Thus, despite the increasing need of the construction organizations for capacities, their increase is proceeding extremely slowly, which leads to a lag of putting major oil and gas pipelines, pumping and compressor stations and objects for development of fields into operation.

A difficult situation has developed in housing construction. This leads to an increase of personnel turnover, which, besides a direct economic loss (establishing a single worker in this region costs 17,000-20,000 rubles), causes high losses due to complexities with development of permanent and stable brigades, sections and shops.

A serious problem is the fact of the towns occupied by the families of oil and gas workers. As the oil and gas fields in different regions of the sector are brought up to maximum production, the volumes of drilling and construction are reduced and new industries must frequently be created on an urgent basis to occupy the populace. But if this is feasible in the European part of the country, is it efficient in the Arctic? It is important to have the future layout of settlement. Should new large cities be created or is it sufficient to expand existing base cities and to create watch settlements? These questions require an answer.

Much has been done to solve the transport problem in Western Siberia. The large construction organization which previously constructed the

Abakan-Tayshet routes was redeployed here for construction of the Tyumen'-Surgut railroad. During the construction, the railroad was laid to Nizhnevartovsk and then to Urengoy. The builders are coping with their tasks, and, thinking about the future, are introducing various proposals--extend the railroad to Noril'sk and so on. However, there is no final solution of the problem. Debates are now going on and part of the construction detachments, on formation of which much effort and time was expended, is beginning to organize its own activity. At the same time there is no confidence that the transportation shortage will be completely eliminated after the Tyumen'-Tobol'sk-Surgut-Nizhnevartovsk-Urengoy railroad is turned over for operation.

For complex solution of the enumerated problems, it is necessary even today to have a general plan for development of the Western Siberian oil and gas complex at least to the year 2,000. Only Gosplan of the USSR can now compile this plan through the efforts of its own scientific research institutes with recruitment of all sectors of industry operating in Western Siberia. The matter should now be turned over to SOPS [Council for the Study of Productive Resources] and VNIIKTEP [expansion unknown] attached to Gosplan of the USSR and development of this plan should be begun.

Far from all the problems of developing the Western Siberian oil and gas complex have been enumerated in the given article. But it is clear from the foregoing how important it is in the country's national economy. The task of all managing bodies of the national economy is to solve the problems of development of the Western Siberian oil and gas complex in a complex manner and on time.

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OIL, GAS STUDIES OF DNEPR-DONETS DEPRESSION

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[Article by V. A. Aver'yev, I. I. Bartkiv, M. I. Blank, G. I. Vakarchuk, I. V. Vysochanskiy, V. G. Dem'yanchuk, V. A. Ivanishin, G. I. Kaledin, V. V. Krot, G. P. Kozak, M. F. Manyuta, S. S. Mikul'skiy, V. I. Myasnikov, D. Ye. Nedzel'skiy, A. M. Paliy, V. A. Raznitsyn, and F. F. Khmel': "Primary Results of Regional Geological-Geophysical Oil and Gas Investigations in the Dnepr-Donets Depression in 1976-1978 and the Plan of Work for the 11th Five-Year Plan"]

[Text] In the first three years of the 10th Five-Year Plan 42 parametric wells were being drilled in the Dnepr-Donets depression; 28 of them were completed. The total volume of parametric drilling was 119,924 meters, and the total cost was 43.7 million rubles. The cost of drilling one running meter was 364 rubles, while the ratio of the volume of parametric drilling to all deep drilling was 11 percent. The average depth of parametric wells at which drilling had been completed was 4,727 meters. During the period under consideration 4,899 running kilometers of refracted wave correlation profiles were processed at a cost of 6,619,000 rubles.

The principal objectives of parametric drilling were linked to study of the Devonian, Lower Carboniferous, and in part Middle Carboniferous. Regional seismic exploration together with parametric drilling in the central and southeastern parts of the Dnepr-Donets depression helped resolve the problem of its tectonic structure.

The drilling of a series of wells in the Devonian complex, including the Krasnopartizanskiy standard profile, was completed in the 10th Five-Year Plan. During drilling on the Krasnopartizanskiy profile in particular it was established that the most interesting structures for oil and gas in the salt domes are not the arches but rather the sides of the structures because the intersalt beds taper out toward the arch where the upper (Frasnian) and lower (Famennian) salts merge.

As shown by drilling at the Raishchenskaya site (well No 325), the "Gribovorudnyanskiy" type of Devonian cross-section does not develop in the direction of the Bragin prominence. Effusive rocks are widely distributed there; intersalt and subsalt complexes are represented by rocks with very poor collective properties.

In the extreme northwestern part of the Dnepr-Donets depression the Devonian intersalt beds have porosity of up to 18-20 percent only in some places, while the Yevlanovskiy-Livenskiy beds have porosities of 6-19 percent. The lower and upper salts may act as screens. Thus, if we base our thinking on data from the Khreshchatinskiy-Krasnopartizanaskiy standard profile where there are collectors, roofs, and a structure, we may conclude that the explanation for negative drilling results in the Devonian in the extreme northwestern part of the Dnepr-Donets depression is not the absence of pools, unreliability of roofs, or nonoptimal structural conditions, but rather the poor promise of such rocks.

Devonian prospects improve in a southeasterly direction, which is illustrated by industrial or near-industrial flows in parametric wells at the Gorobtsovskiy and Zachepilovka sites, in exploratory wells at Rudenki and Sagaydak, and at sites in the northern lateral zone.

Another important result of Devonian drilling should be recognized in the identification of thick strata of intersalt beds in the Malodevitskiy basin (Galician parametric well No 1 and Petrovskiy No 1) and the existence of a narrow lateral trough filled with Devonian deposits at the Orel'skiy-Zatyshnyanskiy site. The tapering out of the Devonian where the sedimentary complex sinks deep into the depression is possibly local, but determination of this fact is not very important.

Drilling data from the group of Lysyye Gory parametric wells in the northern lateral zone showed that the Devonian cross-section is significantly curtailed at this site at the expense of the upper Famennian part.

In a tectonic sense there is a divergence between geophysical findings and drilling data. Drilling does not confirm the notion of geophysicists that the structural planes of the Devonian and Carboniferous correspond, that is, that the Lysyye Gory prominence has an anticlinal structure in the Devonian. In other words, we are dealing with a monoclinal occurrence of the Devonian in the marginal stage with its surface inversely tilted toward the northern side. Structural forms of this type are typical of the Pripyat trough, but they have not been identified in the Dnepr-Donets depression.

The parametric drilling findings for the Lower Carboniferous complex expanded the boundaries of promising horizons and territories. For example, oil and gas prospects were identified in the Lower Visean and Tournaisian beds at the Vostochno-Ozeryanskiy site (well No 312). Similar results are expected at the Sloboda site (well No 321). A flow of combustible gas was obtained from Visean rock at well No 415 (Ol'shanka), and Lysyye Gory well No 233 has produced petroleum. The gas condensate gusher from Visean beds at parametric well No 1 at the Yarovaya site in the Zhdanovsk trough provided the impetus for prospect drilling at the Yablunovskiy site, where a deposit was discovered.

A zone of similar importance has been identified in the region of the Kotel'va-Berezovka ridge where well No 485 revealed good oil and gas bearing characteristics in rocks of the Serpukhovian and Visean stages. Prospect drilling was organized and confirmed the promise of the ridge.

On the northern margin of the Donets Basin parametric well No 5 at the Muratovskiy site revealed a gas deposit in carbonate biohermal formations of the Serpukhovian stage which established the independent direction of parametric drilling in this region.

In the Middle Carboniferous beds parametric drilling was carried out at the Melikhovskiy site (well No 30, where a gas-water discharge occurred while cutting through the beds of the $C_2{}^5$ suite, which makes it possible to characterize this as a promising region for oil and gas.

The basic results of seismic exploration by correlation of refracted waves, performed by the Ukrgeofizrazvedka [Ukrainian Geophysical Exploration] Trust, are as follows:

1. Together with prospecting work by the OGT [expansion unknown] method, the trace of the marginal dislocation between the regional refracted wave correlation profiles from the Pluzhnikovskiy prominence to the Khar'kov prominence in the northern part and from the Belotserkovskiy prominence to the Orel'skiy prominence in the southern marginal part was defined more precisely.

2. The northwesterly strike of the structural elements of the surface of the basement of the Dnepr graben and the fact that it is broken by faults which are primarily longitudinal, with some transverse, were confirmed.

3. The maximum bend of the surface of the basement of the Dnepr-Donets depression in its axial part was confirmed.

4. The marginal zones of the Dnepr graben have a depth of 4.0-7.5 kilometers to the surface of the basement in the central part and 4.5-9 kilometers in the southeastern part of the Dnepr-Donets depression; the amplitude of the marginal fault ranges from 0.25 to 0.5 kilometers (in the prominences) to 2.5-3.0 kilometers (in the depressions).

5. The development of the large Novotroitskiy-Bogodukhov prominence in the northern marginal part was established, analogous to the Lubny-Belotserkovskiy prominence in the southern marginal part of the depression.

6. Significant detail was added to the structure of the northern marginal part and northern side of the Dnepr-Donets depression and the structural elements established within them.

7. From survey materials it was established that the structural plan of the basement surface is inherited by overlapping Devonian and Carboniferous beds; however, where there is development of significant thicknesses of salt-bearing beds forming lens-like bodies and diapirs, the structural plans of the Devonian and Carboniferous intersalt and suprasalt formations become more complex.

8. Hypsometric constructions of the basement of the Dnepr-Donets depression were made to the Khar'kov-Pavlograd profile, with the exception of a small axial part of the graben where the Solokhovskiy and Chutovo-Raspashnovskiy depressions were found.

The Dneprogeofizika Trust made studies in the southeastern part of the Dnepr-Donets depression and in the Donets Basin. The grid of refracted wave correlation and deep seismic sounding profiles they set up enabled them to construct a structural tectonic map of the surface of the basement. According to geophysical data this surface has a block structure. Within the Dnepr graben there is a narrow, asymmetric Riphean trough bounded by deep faults. The existence of a Riphean graben is not recognized by all geologists at all.

The Dnepr-Donets depression joins the Voronezh crystalline massif and the Ukrainian shield along deep faults. Data from regional geological and geophysical work in the first three years of the 10th Five-Year Plan provide considerable guidance to further studies. In the plan of the 11th Five-Year Plan the Lower Carboniferous will be considered in a differentiated manner, which was not done in the 10th Five-Year Plan. New petroleum and gas bearing complexes are being identified in its cross-section. The Lower Carboniferous is no longer viewed as the only stratum of rock offering good oil and gas prospects. Its stages and substages are now being evaluated separately. The New Tournaisian, or more broadly the Tournaisian-Lower Visean complex, a regional oil-gas bearing complex, and the Upper Serpukhovian (Namurian) oil and gas complex, whose rocks were formerly considered a fluid trap, have recently become paramount.

As the lithofacies characteristics of the Paleozoic cross-section are studied, conventional ideas of the character of horizons and strata from the standpoint of their lithology and their reservoir and screening properties change, as can be observed in the particular case of the upper stages of the Lower Carboniferous. Opinions concerning the persistent thickness of the Lower Carboniferous with proportional, even increase in size toward the axis of the Dnepr-Donets depression and to the southeast have been severely shaken and are now already outdated. For example, no one believes that the Tournaisian is a suite of 100-200 meters at the base of the Lower Carboniferous. The thickness of the Tournaisian increases by leaps from 0-100 meters to 1,000-2,000 meters. The same thing applies to transitional layers in the Devonian (zone $C_1{}^ta$; XVa microfauna horizon) which are oil and gas bearing strata and increase to 1,000 meters and more in thickness at some points. The thickness of the entire Lower Carboniferous also varies sharply. A number of other questions of the stratigraphy of the Devonian-Carboniferous and the tectonic, structure, and development of local structures — salt dome and inherited structures linked to block movements of the basement — have been clarified.

The Devonian problem has been practically solved, which is to say that oil pools have been found in the Devonian and gas flows close to industrial value have been established. For the first time in the Dnepr-Donets depression parametric wells identified gas pools in carbonate reservoirs of the Serpukhovian and Tournaisian stages (Bogatoyskiy and Muratovskiy sites) which may be reef formations. All these things taken together determine new directions of investigation and make changes in old ones. The plan for the 11th Five-Year Plan envisions the following areas of investigation and calls for drilling these wells:

1. Study of the geological structure and evaluation of oil and gas prospects in the Devonian:

   a. in the southern lateral zone -- Malodevitskiy well No 332 (6,000 meters, PCm), Sukhonosovskiy 423 (5,600 meters, PCm), Bogatoyskiy (Buchkovskaya) well No 474 (6,500 meters, $D_{subsalt}$), Svechanskiy 473 (5,500 meters, D_3zd);

   b. in the axial zone -- Guzhevskiy well No 305 (5,900 meters, PCm), Pashkovskiy 351 (5,000 meters, PCm), Chizhevskiy 472 (5,500 meters, D_3zd), East Poltava 33 (12,00 meters, PCm);

   c. in the northern lateral zone -- Borznyanskiy well No 303 (5,700 meters, PCm), Velikozagorovskiy 316 (5,600 meters, PCm), Gayvoronskiy 304 (6,000 meters, PCm), Talalayevskiy 311 (5,700 meters, PCm), Velikobubnovskiy 317 (5,300 meters, PCm), Novotroitskiy 458 (5,800 meters, PCm), Sidoryachskiy 484 (5,500 meters, D_3zd).

2. Study of the geological structure and evaluation of oil and gas prospects of the Tournaisian-Lower Visean complex:

a. in the southern lateral zone -- Reshetnyakovskiy well No 419 (5,700 meters, C_1t), Skarbnyy 480 (6,000 meters, C_1t), Orchikovskiy 436 (5,400 meters, C_1t), Osipovskiy 437 (4,500 meters, C_1t), Pereshchepinskiy 438 (4,600 meters, C_1t-D_3fm), Mazharovskiy 493 (5,700 meters, C_1t), Yekaterinovskiy 623 (5,500 meters, C_1t), Lozovskiy 622 (5,500 meters, C_1t), Bliznetsovskiy 621 (5,000 meters, C_1t);

b. in the axial zone -- Tarasovskiy well No 347 (4,400 meters, D_3), Severo-Lelyakovskiy 363 (5,100 meters, D_3), Savinkovskiy 361 (5,800 meters, D_3), Gorobiyevskiy 360 (5,400 meters, D_3), Lebedintsevskiy 320 (6,500 meters, D_3), Voloshkovskiy 314 (5,700 meters, D_3), Zor'kovskiy 370 (5,950 meters, C_1t), Chernovoslobodskiy 368 (5,900 meters, C_1t), Peskovskiy 371 (5,800 meters, C_1t), Selyukhovskiy 425 (5,500 meters, D_3), Okopovskiy 365 (5,000 meters, D_3), Yuzhno-Pogarshchinskiy 463 (5,800 meters, C_1t), Severo-Pogarshchinskiy 461 (5,800 meters, C_1t), Khar'kovtsevskiy 409 (5,800 meters, C_1t), Lysovskiy 444 (6,200 meters, C_1t), Borkivskiy 451 (6,600 meters, C_1t), Semiren'kovskiy 446 (6,200 meters, C_1t), Gogolevskiy 494 (6,800 meters, C_1t), Solokhovskiy 495 (6,200 meters, C_1t), Volvenkovskiy 608 (5,500 meters, C_1t);

c. in the northern lateral zone -- Bel'machevskiy well No 348 (3,650 meters, PCm), Dmitriyevskiy 362 (6,000 meters, PCm), Bobrikskiy 372 (5,900 meters, D_3), Pobivanskiy 454 (5,100 meters, C_1t), Yuzhno-Gadyachskiy 431 (5,500 meters, C_1t), Pirkovskiy 460 (5,500 meters, C_1t), Bel'skiy 470 (6,000 meters, C_1t), Iskorvskiy 490 (6,800 meters, C_1t), Murafskiy 620 (4,500 meters, C_1t), Kolomakskiy 611 (6,900 meters, C_1t).

3. Study of the geological structure and evaluation of oil and gas prospects of the Upper Visean-Serpukhovian complex:

a. in the southern lateral zone -- Gersevanovskiy well No 617 (5,800 meters, C_{1V2});

b. in the axial zone -- Yuzhno-Gogolevskiy well No 457 (4,500 meters, C_{1S}), Slavkovskiy 434 (4,000 meters (C_{1S}), Yuzhno-Abazovskiy 433 (4,500 meters, C_{1S}), Gavrilkovskiy 471 (5,500 meters, C_{1V2}), Svetlovskiy 607 (7,000 meters, C_{1V2}), Slavyanskiy 613 (6,000 meters, C_{1V2}), Yampol'skiy (5,500 meters, C_{1S}), Verolyubovskiy 626 (5,500 meters, C_{1S});

c. in the northern lateral zone -- Zapadno-Khmelevskiy well No 343 (3,200 meters, PCm), Mukhovatovskiy 366 (3,200 meters, PCm).

4. Study of the geological structure and evaluation of oil and gas prospects of the Middle Carboniferous complex:

a. in the axial zone -- Zaturinskiy well No 407 (4,950 meters, C_2), Chutovo-Raspashnovskiy 448 (7,000 meters, C^2), Zapadno-Krestishchenskiy 70 (6,500 meters, C_{2b}), Kobzevskiy 624 (7,000 meters, C_2), Svyatogorskiy 609 (4,900 meters, C_2), Ocheretinskiy 627 (5,000 meters, C_2);

b. in the northern lateral zone -- Zmiyevskiy well No 602 (6,000 meters, C_{2b}).

5. Study of the geological structure and evaluation of oil and gas prospects of the Upper Carboniferous-Lower Permian complex:

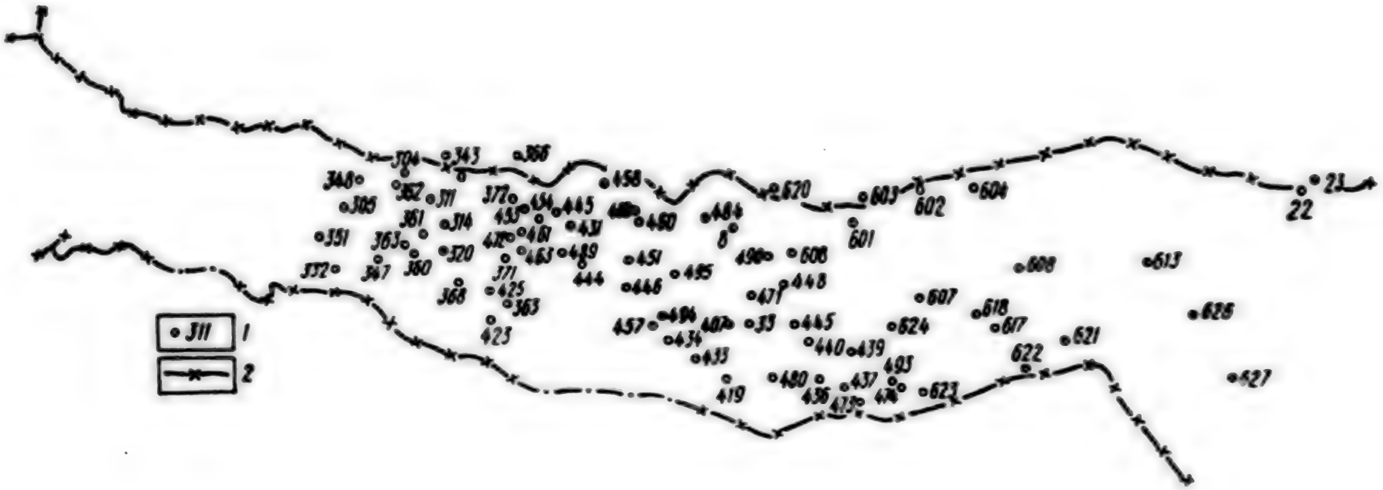
a. in the axial zone -- Yelizavetovsko-Tarasovskiy well No 443 (5,800 meters, C_3), Fedorovskiy 440 (4,400 meters, C_3), Severo-Oktyabr'skiy 439 (4,400 meters, C_3).

For the 11th Five-Year Plan overall 79 wells with a total of 282,000 running meters are to be drilled in the Dnepr-Donets depression; this is 15 percent of the total volume of deep drilling. Fifteen wells are scheduled for study of the Devonian complex, 39 for study of the Tournaisian-Lower Visean, 15 for the Upper Visean-Serpukhovian, seven for the Middle Carboniferous, and three for the Upper Carboniferous-Lower Permian.

Plans for regional seismic exploration by correlation of refracted waves envision further detailed clarification of the hypsometry of the basement in the southeastern part of the depression in order to construct a map to the Pavlograd-Khar'kov profile and a map of the surface of the basement in the Bakhmutovka and Kal'mius-Toretskiy basins. Further detailed study will be made of the traces of marginal faults and of the relationship between the structural plans of the basement surface and overlapping beds of various ages.

By a resolution of 29 March 1979 the Scientific-Technical Council of the Kiev geophysical expedition proposed continuation of detailed hypsometry of the basement in the southeastern part of the depression to insure construction of a map of the relief of the basement to the Sinel'nikovo-Chuguyev profile.

To meet these challenges, plans for 1981-1985 envision processing 5,000 running kilometers of refracted wave correlation profiles at a cost of 7 million rubles. In addition, 1,000 running kilometers of reconnaissance profiles are to be profiled by MOGT [possibly reflected wave technique] at a cost of 2 million rubles, and 1,520 running kilometers of MOGT profiles (3.36 million rubles) at known structures plus 9,000 square kilometers of gravimetric surveying (900,000 rubles) will be done.



Location of Parametric Wells in the Dnepr-Donets Depression for the 1981-1985 Plan of Work: (1) Planned Parametric Wells; (2) Marginal Dislocations.

The map shows the locations of the planned wells in all work sectors. Performance of the work planned for the 11th Five-Year Plan will enable us to identify new sites and new directions of prospecting work.

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FUELS

SHORTCOMINGS OF DEVELOPING URENGOY GAS DEPOSIT HIGHLIGHTED

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 23 Jan 80 p 2

[Article by L. Kostylev, correspondent of TYUMENSKAYA PRAVDA, and V. Noskov, correspondent of SOTSIALISTICHESKAYA INDUSTRIYA (Novyy Urengoy, Tyumenskaya Oblast): "2. The Relay Race of the Firstling"; part 1 was published in FBIS Daily Report, Vol III, 31 Jan 80]

[Text] Novyy Urengoy, a gas-field workers' settlement near the Arctic Circle, is growing extraordinarily rapidly. While at the start of the five-year plan there were few more than a thousand people here, today there are 18,000.

People are coming here, to the All-Union Komsomol shock-work construction project, from all over the country. But mainly they are coming here alone, without the family. Why? They don't want to bring members of their households to a frigid district? No, there is a different reason. Even an experienced specialist here can count at best on a bed in an overcrowded trailer or hut on skids. Many take shelter in the locker rooms of operating buildings. Only about 4,000 are living in the hewn wooden housing, which is far from being the best adapted to the local climate.

"Lucky ones!" says painter N. Zav'yalova about them with envy. "But my husband and I do not have a roof over our heads at all. We were summoned here and had a letter guaranteeing housing space in a trailer. But for 3 months now we have been spending the night with acquaintances. We will wait a little bit longer, of course. But then, surely, we will have to return to our place in Ul'yanovskaya Oblast--there is no other way out."

Most of the settlement's new arrivals are in the same situation. This is why some organizations have a complete turnover in a year, not only of new people leaving but also of people who have been proved by the North. The statistics show that in half a year, a third of the newcomers will leave Novyy Orengoy.

In the deep-drilling party, for example, 180 people were received in 9 months of last year, and 110 quit. The main reason for quitting was failure to be provided with housing. This party--it is the oldtimer of the settlement--has at its disposal 12 apartments and some tens of places in dormitories. But the collective is manned by 600 people.

Not only is it difficult with housing. The requirement for schools and hospitals has been met by half, for bathhouses and laundries by one-third, and for kindergartens by 13 percent. With a severe shortage of workhands, about 400 women are compelled to sit at home with children. The pharmacy and personal-services combine are located in crowded premises not adapted to the purpose.

The question can arise: but where can all this be obtained, for the settlement rose up literally on a bare spot in the primordial tundra. All this is true. But 7 years have passed since the first party landed here. For comparison, let us cite this fact. In 5 years after start of the development of Samotlor's oilfield, the modern city of Nizhnevartovsk had risen up along with it. Oilfield workers, while developing the field, simultaneously built housing for themselves and facilities for social, cultural and personal-services purposes. Why didn't the gas-field workers take into consideration this experience, which is to be found not across the seven seas but right alongside them?

The disproportion between the construction of operating buildings and of housing has become a serious hindrance to Urengoy's development. Two years ago a decision was adopted that required Mingazprom [Ministry of Gas Industry] and Minneftegazstroy [Ministry of Construction of Petroleum and Gas Industry Enterprises] to set the situation right within a short time. The ministries, however, have done little on the planned program. The arrears in housing is about 40,000 square meters. The planned schools, kindergartens and club do not exist.

The main cause of the situation that has been created is the lag in the construction-industry base. Minneftegazstroy managers, in preparing to develop Urengoy, adopted a praiseworthy decision: "No temporary housing of any kind! We will develop the future city with multistory housing from the start." But while relying upon permanent-type buildings, they overlooked the question, of no little importance, of where they will be made.

Three years ago First Deputy Minister Yu. Batalin ordered the delivery of three large-panel type buildings to Novyy Urengoy from the Surgut Housing Construction Combine. The long-range concept of this order was clear: although the first swallow does not a summer make, others will come after it. But, unfortunately, this did not happen.

While being oriented to the Surgut and Nadym housing-construction combines, Minneftegazstroy did not undertake to develop them in earnest. The first of these combines mainly supplies housing to Ob' region oilfield workers, and, moreover, during all the years of its existence has not once fulfilled the plan. The second is still operating at one-third of its designed capacity, although it is already drawing up its second five-year plan. On top of it all, both enterprises experience a chronic shortage of building materials, a geological search for which in this region was ordered only last year.

At one time Minneftegazstroy planned to build a brick plant in Nadym. Raw-material reserves would have sufficed for at least 40 years with an enterprise with a productivity of 50 million bricks per year. But erection of the plant was discarded, since this would require many expenditures. But indeed, is it cheaper to send here millions of bricks, whose cost, taking hauling expenditures into account, comes to about 1 ruble per brick?!

The development of Urengoy has, in essence, only begun. Deep sediments rich in condensate await their hour. The erection of a plant for treating it will start soon. According to the most modest estimates, as many as 70,000 people will be living here by 1985. However, neither Mingazprom nor Minneftegazstroy has yet made up a concrete program for the construction of the housing and facilities for social, cultural and personal-servces purposes. Yet it is intended that Urengoy will be the springboard for the establishment of numerous satellites of the gas giant, for a further advance by gasfield workers and geologists into the northeast of Tyumen' land.

Right now the settlement, despite the original schemes, is being developed basically with wooden housing, which, in our view, is not so bad. Tyumenskaya Oblast has at its disposal vast forest reserves. So why wasn't this reserve used from the first? And here is a paradox: wooden parts of buildings are being brought to Urengoy from all parts of the Soviet Union, and they are not of the best type. They are importing, for example, housing made of squared beams that were designed for a minimum temperature of -40 degrees, but here it gets 10-15 degrees lower. The enormous parts mix is about 270 items, and the complicated transport scheme, with many transshipments, makes it difficult to bring together all the parts for buildings. Panel buildings, the so-called BAM-type housing, are preferable for local conditions. They are warmer than the squared-beam buildings and are much easier to assemble. But the Northerners have received very few of them.

The conclusion suggests itself: arrange for the production of wooden housing in Tyumenskaya Oblast. Such a decision is more expedient also because in recent years Tyumenlesprom [Association for Timber Production in Tyumenskaya Oblast] has not been coping with the plan for delivering timber to customers because of a shortage of railroad cars. Hundreds of thousands of cubic meters of timber, which rots in stacks, have been accumulated in the downstream timberyards of timber procurement establishments. So why not release them for the job?

If the production of wooden housing were to be organized on a wide scale here, this could not be done without the help of USSR Gosstroy and Gosgrazhdanstroy [State Committee for Public-Building and Housing Construction and Architecture]. The Northerners should expect new designs from them. No matter how good the BAM housing is, it is rather far from meeting modern requirements. Externally the housing is homely, and the layout is not so convenient. But the conquerors of Siberia's underground riches have the right to count on warm, comfortable and attractively formulated prefabricated wooden housing that corresponds completely to the peculiarities of the local climate.

In his speech at the November 1979 CPSU Central Committee Plenum, Comrade L. I. Brezhnev set the task of displaying heightened concern about cultural and personal-services facilities in Siberian regions that are being developed. In light of this instruction, it is obvious that the time has come to confer on Novyy Urengoy the status of a city, with the administrative organizations and services that correspond to that rank.

The Arctic gas giant is receiving from Samotlor the relay baton of primacy in the country's fuel and power balance. At the beginning of next year the field will be first in the USSR in daily recovery of gas, and in the not-so-distant future it will produce as much as is received today at all our fields. The uniqueness of Urengoy requires special responsibility on the part of all participants in the development of this pearl of the Arctic.

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GASLIFT EXTRACTION AT SAMOTLOR, PRAVDINSK DEPOSITS

Moscow EKONOMIKA NEFTYANOY PROMYSHLENNOSTI in Russian No 12, Dec 79
pp 11-14

[Article by A. V. Pavlova, L. A. Permyakova, and V. A. Popov, SibNIINP: "The Economic Efficiency of Improving Technology for the Gaslift Method of Petroleum Extraction"]

[Text] Gaslift well exploitation is being practiced at two oil fields in Western Siberia, Samotlor and Pravdinsk. The former uses a scheme without compressors, while compressor gaslift is used at the latter. Figures 1 and 2 below show the development over time of the principal industrial indexes of gaslift well exploitation compared to pumping.

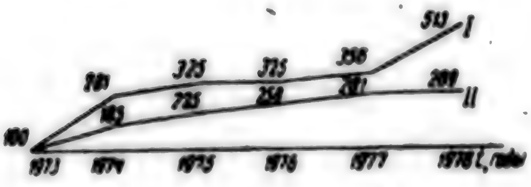

Figure 1. Oil Extraction at Glavtyumenneftegaz (as % of 1973):
I — Pumping Extraction;
II— Gas Lift Extraction.

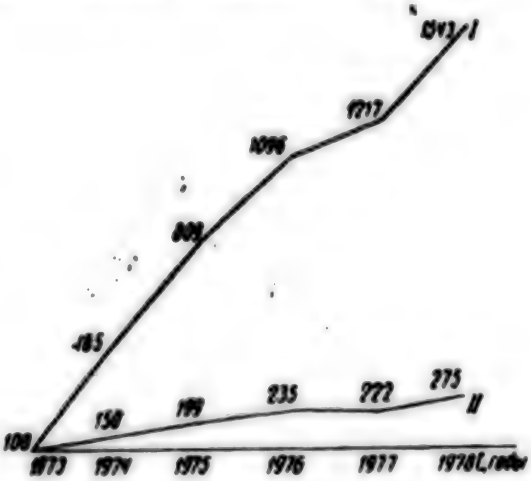

Figure 2. Average Annual Producing Wells at Glavtyumenneftegaz (as % of 1973):
I — Pumping;
II— Gas Lift.

Whereas gaslift wells comprise six percent of all wells for Glavtyumenneftegaz [Main Tyumen' Production Administration for Extraction of Petroleum and Gas] with four percent of total petroleum extraction in 1978, in the future these indexes will rise considerably.

The prospects for application of gaslift exploitation are linked to certain advantages of this method over traditional pumping methods. Among these advantages are the high recovery coefficient and period of operation of gaslift wells between repairs, the possibility of utilizing by-product petroleum gas, and insuring large take-offs of liquid, reducing the specific number of industrial production personnel, and others.

In addition to advantages, this method also has shortcomings. The primary shortcoming is the comparatively low efficiency of gaslift wells and the large amount of capital investment required to set up a gaslift complex. Therefore, while the gaslift method has been put into use at these deposits efforts have also been made to refine the technology.

This article gives basic results from an economic evaluation of activities related to improving the technology of gaslift petroleum extraction at the above-mentioned deposits. It has been established by analysis of the operation of these gaslift wells that there are ways to improve their efficiency by reducing pressure losses from gas slippage, feeding the gas deeper into the lift, and establishing optimal operating regimes for gaslift wells by redistribution of the working agent in them.

To improve the efficiency of gaslift wells, dispersed gas devices were introduced at the Pravdinsk deposit in 1976-1978 and made it possible, by breaking down the gas phase, to lessen its negative effect on the lift process, reduce the specific expenditure on gas per gaslift well, and increase its yield [1, 2].

To feed the working agent more deeply into the lift a methodology has been developed and employed at the Pravdinsk deposit for the placement of starting valves in slant wells. The previous methodologies were figured for vertical lifts and did not permit the gas to penetrate deeply enough into the lift.

In the third area of work to raise efficiency, 20 wells at the Pravdinsk deposit introduced small-operation technology for analyzing and selecting the working regime of gaslift wells which made it possible to distribute the working agent among the wells on an operational basis and reduce specific expenditure of the agent.

At the Samotlor deposit the basic extraction scheme has been altered to reduce the capital-intensiveness of the gaslift method. The former plan envisioned operation of some wells by non-compressor gaslift. The introduction of two self-contained non-compressor gaslift circuits with gas-takeoff wells located right at the cluster site made it possible to avoid drilling two special gaslifts, constructing a gas preparation installation, laying high-pressure gaslines, and building gas distribution batteries [3].

The economic evaluation of the measures enumerated above, carried out with due regard for the basic points of standard methodologies [4, 5], showed that the results are excellent (Table 1 below).

According to these data the most efficient measures during the period under consideration were introduction of dispersed gas devices and self-contained non-compressor gaslifts.

In the former case the annual economic impact per well was 18,600 rubles, while in the latter case it was 45,400 rubles.

The steps taken to improve the efficiency of gaslift wells in 1974-1978 made it possible to increase extraction at the Pravdinsk deposit by 706,600 tons with an economic impact of 3.1 million rubles and the tentative release of 74 employees.

The introduction of schemes for self-contained non-compressor gaslift at the Samotlor deposit made it possible to save capital investment by not drilling two specialized gas wells costing 332,900 rubles and to release, hypothetically, 10 personnel from the production process.

Additional capital investment during the particular period was linked to the technique for arranging starting valves and with self-contained non-compressor gaslift circuits. These additional capital investments were repaid within a month.

In addition, introduction of steps to improve gaslift technology fostered an improvement in the economic accountability indexes of the enterprises (see Table 2 below).

Thus, the introduction of dispersed gas units enabled the Pravdinsk Oil and Gas Extraction Administration to increase profit by 1.5 million rubles in 1976-1978 and the average annual growth and total profitability was 0.16 percent.

The use of fixed capital by oil and gas extraction enterprises rose significantly. For example, during the time 1974-1976 the average annual growth in return on capital at the Pravdinsk Oil and Gas Extraction Administration (2.2 percent) was achieved by introducing the technique of placing starting valves. In 1976-1978 the introduction of dispersion units made possible achieving an average annual growth of one percent in return on capital. For the entire period 1974-1978 the introduction of these measures made possible an average increase of two percent in the use of fixed capital.

Table 1. Results of a Calculation of the Economic Efficiency of Taking Steps to Improve Gaslift Technology.

Внедрение мероприятий (a)	Годы внедрения (b)	Объем внедрения, скв. (c)	Прирост добычи нефти, тыс. т (d)	Условное высвобождение работающих, чел. (e)	Срок окупаемости дополнительных капитальных вложений, дни (f)	Годовой экономический эффект, тыс. руб. (g)
(1) Метода расстановки пусковых клапанов в наклонных газлифтных скважинах Правдинского месторождения	1974	80	175,0	18	7	725,3
	1975	70	161,0	13	15	684,4
	1976	50	106,5	13	11	479,8
	1974—1976	200	442,5	44	—	1889,5
(2) Технологических схем автономного бескомпрессорного газлифта на Самотлорском месторождении	1975	8	540,4	10	7	363,5
(3) Устройств диспергирования газа на Правдинском месторождении . .	1976	15	115,0	14	—	524,7
	1977	25	62,1	7	—	298,0
	1978	18	61,0	6	—	256,8
	1976—1978	58	238,1	27	—	1079,5
(4) Групповой малооперационной оптимизации режимов работы газлифтных скважин Правдинского месторождения	1978	20	26,0	3	—	111,7
	1974—1978	1247,0	217,3	84	—	3444,2

Key:
- (a) Introduction of Measures;
- (b) Year of Introduction;
- (c) Scope of Introduction, wells;
- (d) Growth in Petroleum Extraction, thousands of tons;
- (e) Hypothetical Number of Employees Released;
- (f) Payback Period on Additional Capital Investment, days;
- (g) Annual Economic Impact, thousands of rubles.

- (1) Method of Arranging Starting Valves in Slant Gaslift Wells at the Pravdinsk Deposit;
- (2) Technological Schemes for Self-Contained Non-Compressor Gaslift at the Samotlor Deposit
- (3) Dispersed Gas Devices at the Pravdinsk Deposit;
- (4) Small-Operation Group Optimization of the Working Regime of Gaslift Wells at the Pravdinsk Deposit.

Table 2. The Effect of Steps to Improve Gaslift Exploitation Technology on the Economic Indexes of Enterprise Work.

Внедрение мероприятий (a)	(b) Годы	(c) Прирост прибыли, тыс. руб.	(d) Прирост общей рентабельности, %	(e) Прирост фондоотдачи, %
(1) Метода расстановки пусковых клапанов в наклонных газлифтных скважинах (НГДУ «Правдинскнефть»)	1974		0,8	2,8
	1975		0,39	2,4
	1976		0,35	1,5
	1974—1976	3589,3	0,51	2,2
(2) Технологических схем автономного бескомпрессорного газлифта (НГДУ «Нижневартовскнефть»)	1975	5130,1	1,1	0,6
(3) Устройств диспергирования газа (НГДУ «Правдинскнефть»)	1976		0,24	1,6
	1977		0,13	0,7
	1978		0,10	0,6
	1976—1978	1522,0	0,16	1,0
(4) Групповой малооперационной оптимизации режимов работы газлифтных скважин (НГДУ «Правдинскнефть»)	1978	168,5	0,04	0,3
(5) Итого:	1974—1978	10241,4	0,41*	2,0*

Key:
(a) Introduction of Steps; (b) Year;
(c) Growth in Profit, thousands of rubles;
(d) Growth in Overall Profitability, %;
(e) Growth in Return on Capital, %;

(1) Technique of Placing Starting Valves in Slant Gaslift Wells (Pravdinsk Oil and Gas Extraction Administration);
(2) Technological Schemes for Self-Contained Non-Compressor Gaslifts (Nizhnevartovsk Oil and Gas Extraction Administration);
(3) Dispersed Gas Units (Pravdinsk Oil and Gas Extraction Administration);
(4) Small-Operations Group Optimization of the Working Regimes of Gaslift Wells (Pravdinsk Oil and Gas Extraction Administration).
(5) Total.

*The growth in overall productivity and return on capital for the entire period 1974-1978 was determined for the Pravdinsk Oil and Gas Extraction Administration.

Conclusions

1. In the period 1974-1978 Glavtyumenneftegaz received an increase of 1.2 million tons in oil extraction, an economic impact of 3.4 million rubles, hypothetical release of 84 employees, and more than 10 million rubles of additional profit by taking steps to improve gaslift technology.

2. These results permit consideration of these activities when planning gaslifts at other deposits in Western Siberia, which will raise the technical-economic indexes of exploitation of those deposits.

FOOTNOTES

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3. Pavlova, A. V., Permyakova, L. A., and Sysoyeva, L. I., "Results of the Introduction of Non-Compressor Gaslift at the Samotlor Deposit," RNES EKONOMIKA NEFTYANOY PROMYSHLENNOSTI 1977, No 1, pp 24-25.

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